SAUGEEN VALLEY

CONSERVATION REPORT

1952

DEPARTMENT OF PLANNING & DEVELOPMENT

FOREST PLANTATIONS

The Saugeen Watershed contains many thousands of acres where trees are the crop which will yield the highest financial returns. At 30 years of age a red pine plantation such as this should yield in thinnings alone 10 cords of wood per acre at a profit of $3 per cord or $30 per acre. At 60 years it should have returned to the owner in thinnings, poles and saw logs a net profit of $445 per acre. Grey County has realized this for some years in establishing County Forest Tracts. The Saugeen Authority is building up the Authority Forest, and private owners are reforesting their marginal land. The Authority rents tree-planting machines at a nominal charge, and the Zone Forester furnishes advice on planting and management.

DEPARTMENT OF PLANNING AND DEVELOPMENT

THE HONOURABLE WM. GRIESINGER, Minister

A. H. RICHARDSON, Chief Conservation Engineer

SAUGEEN VALLEY CONSERVATION REPORT 1952

ONTARIO

TORONTO
1952

Two hundred copies of this report have been prepared, of which this is

Number 117

Honourable William Griesinger, Minister,
Department of Planning and Development,
Parliament Buildings,
Toronto, Ontario.

Honourable Sir:

I take pleasure in transmitting herewith a Conservation Report on the upper portion of the Saugeen Valley.

The report is in five sections: History, Land Use, Forestry, Water and Wildlife.

Yours very truly,

A. H. Richardson
Chief Conservation Engineer

Toronto, November 26, 1952

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PHOTOGRAPHS

Photographs in this report were taken by the Department of Planning and Development Conservation Branch, except for the following, permission to use which is gratefully acknowledged:

Dunsmoor's dam	Durham Furniture Co.
British Hotel, Durham (from a tintype made in 1858)	Miss Margaret Hunter, Durham
Durham and Jackson Streets, Walkerton, March 17, 1948	Toronto Globe & Mail

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RECOMMENDATIONS

RECOMMENDATIONS
STATED OR IMPLIED IN THIS REPORT

History

1. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners or their commitment to proper care in libraries, museums, archives and other suitable repositories.

2. That when sites or buildings of this kind form part of, or are closely adjacent to, properties acquired by the Authority for flood control, reforestation or recreation, the possibility of including them in the scheme be considered.

3. That in such cases sites be marked and buildings preserved and used for some purpose in connection with the project compatible with retaining their original character.

4. That, before carrying out any project, the Authority ascertain from the Department of Indian Archaeology of the University of Western Ontario whether the area concerned is likely to contain archaeological material and if necessary arrange for the investigation of the site before operations make this difficult or impossible.

5. That a marker be placed on Highway No. 6 at the point, about three miles north-west of Mount Forest, where the line of Rankin's survey of 1837 of the Garafraxa

Road diverges from the line of the present road; and that a similar marker be placed at the point, about three and a quarter miles west of Durham, where Rankin's line of 1837 crosses the present Highway No. 4. p. 17

6. That markers be placed to indicate the site of some of the earliest mills, churches, taverns, etc., in various parts of the watershed, as, for example, on Hunter's Hotel in Durham (p. 18); Edge's Mill (now McGowan's) in Durham (p. 30); Valentine's Mill at Paisley (p. 41); and the Indian sawmill of 1844 near Southampton (p. 28).

7. That from the small number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for eventual inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.

8. That wherever possible, the buildings be left on their original sites and continued in their original use or adapted to some suitable purpose in connection with the normal life of the community.

9. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.

10. That some of these buildings be used to house collections of objects of domestic, agricultural and industrial use and of pictures and documents illustrating the history and development of the area.

11. That in selecting the limited number of buildings and objects that can be preserved in this manner,

care be taken to choose those that best illustrate the development of the area, without undue regard to age, association or artistic merit.

Land Use

12. That the Authority give leadership in promoting methods of land use designed to control erosion and water loss. p. 67

13. That the program of land use for conservation of soil and water include improvement of long-term pastures, crop rotations with emphasis on soil-building crops, and the establishment of grassed waterways on all intermittent watercourses. p. 68

14. That land suitable for long-term pasture which lies beside Authority forests be acquired, improved by the Authority and made available to neighbouring farmers as a self-supporting project and as a demonstration of good land use. p. 68

15. That an experiment be set up in the area known as the Dundalk Silty Plain to determine the possibility and advantages, if any, of tile drainage on this land type. p. 65

16. That the Authority enlist two or more co-operators to adopt methods of erosion control, contour strip-cropping, diversion terraces, grassed waterways, and vegetative methods, to demonstrate these practices in the area. p. 69

17. That the Authority choose one tributary watershed of about 30,000 acres and through a Land Use Advisory Board develop a Valley Plan to show how land can be improved: further, to give direction and assistance in co-operation with other government agencies in establishing soil and water conservation methods on individual farms. p. 68

18. That the Authority arrange technical and material assistance in the creation of farm ponds where usefulness and feasibility can be shown. p. 42

Forestry

19. That the Saugeen Forest be established and that it be expanded through a definite program of annual additions and planting until the total area of 30,028 acres is acquired and reforested. p. 47 and map p. 50

20. That the Authority expropriate all land suitable for reforestation purposes subject to the regulations of the Municipal Act as and when such lands become tax delinquent. p. 86

21. That the Authority set up a committee to determine the best method of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests. p. 73

22. That the Authority encourage the establishment of natural regeneration in and close to existing woodlands by instructing landowners in methods of scarifying soil and breaking sod immediately preceding the dispersal of seed by parent trees. This should be done in early September for most species and early June for elms and soft maples. p. 68

23. That the Authority inaugurate a scheme to aid farmers in fencing their woodlots from cattle. This would enable regeneration to establish itself, restore the spongy cover of leaves and humus over the soil and improve the water-holding capacity of the soil itself. p. 71

24. That the policy of aiding landowners to reforest marginal land be expanded by the Authority. The Authority already furnishes a tree-planting machine

with tractor and operator for a nominal sum and also subsidizes planting on land too rough, too steep and too wet for machine planting. p. 37

25. That the Authority purchase a portable wood chipper which would be made available to farmers in the same way as the tree-planter. This could be used to clean up low-grade hardwood and weed trees in wood-lots. The chips can be used in place of straw for cattle bedding and chicken litter and spread on the fields as humus. In some cases it may be possible to sell such chips to pulp companies.

26. That the Authority support the Provincial School Forestry Competition and 4-H Forestry Clubs by enlisting the help of co-operators, providing transportation where necessary and special recognition of winners. p. 43

27. That the Authority request the Department of Lands and Forests to require all log buyers who purchase logs from Southern Ontario woodlots to publish their log-grade specifications, together with prices offered. p. 134

28. That the Authority set up a committee to publicize the following among woodlot owners and sawmillers, where necessary:

    (a) The advantages of replacing the present system of custom sawing by an arrangement whereby credit is given for "custom logs", and against this credit the farmer receives, at preferred prices, the species, quantity and quality of product best suited to his needs. p. 115

    (b) Lists of buyers who are interested in the purchase of woodlot products. These may be obtained from the Zone Forester. p. 128

    (c) The advantages of soliciting tenders from as many buyers as possible who are within economic operating distance of the woodlot. p. 128

    (d) The advantages and disadvantages of lump sum sale and stumpage rate sale. pp. 127-130

(e) The benefit of having a written Timber Sales Contract for timber on the stump. It is recommended that the Advisory Board, in co-operation with the Zone Forester, prepare a suggested form of contract. p. 130

(f) The arguments in favour of having experienced loggers do the cutting and the owner handle small products, such as fuelwood, posts and bolts. p. 130

(g) That the marking of trees for removal is a technical operation vital to the future of the woodlot, and that it should only be done by the Zone Forester or other trained personnel. p. 139

(h) The importance of having the woodlot appraised prior to selling the farm. p. 125

29. That the Authority make direct representation to the Department of Finance of the Federal Government in support of the recommendation in the Report of the Select Committee on Conservation (1950) that "the Dominion Government should be asked to consider amending the Dominion War Tax Act so that landowners will no longer be penalized for cropping their timber in accordance with conservation practices".

30. That the Authority use its influence to have assessment revised so that land only is assessed, not the timber growing on it, and that the municipality concerned recover its revenue by means of a severance tax imposed at the time the timber is cut.

Water

31. That the channel improvement work and dike as recommended in the report prepared by the Kilborn Engineering Company Limited be carried out. p. 39

Wildlife

32. That the Authority encourage farmers to improve their land for wildlife by the elimination of grazing of woodlots, by selective cutting in woodlots, by improved cultivation practices and by the planting of wildlife food patches. pp. 4, 5

33. That the introduction of fish into the watershed be restricted to those parts of the river shown on the map "Biological Conditions of Streams" to be suitable for the species concerned. pp. 13, 15

34. That the Authority encourage owners and lessees of parts of the Saugeen River to improve them for fish by installing low dams, deflectors and other devices for producing good fish cover. p. 23

35. That fishing clubs and individuals be encouraged to organize a creel census by keeping records of the hours of fishing, the number and lengths and, where possible, scale samples of all fish taken and to make the records available to the Department of Lands and Forests so that the best methods of management of streams for trout can be worked out. p. 25

36. That the Conservation Authority sponsor a demonstration of improvement of a trout stream for fish; alternatively the Conservation Authority might urge a demonstration of stream improvement on one of the trout streams in the Grey County Forest. p. 24

37. That the Conservation Authority use its powers to stop the dumping of sawdust into the Saugeen River. p. 23

38. That the Conservation Authority encourage farmers to construct or improve farm ponds for fish. p. 25

39. That the Conservation Authority inform all those operating dams for power on the Saugeen River of the importance of adjusting the flow of the river so that it is reduced below the dams as little as possible. p. 24

40. That the Conservation Authority consider the possibility of acquiring, or at least urging the acquisition of, a stretch of the Rocky Saugeen for public fishing. p. 24

HISTORY

CHAPTER 1

THE INDIAN PERIOD

Recorded history in the peninsula of Western Ontario begins with the coming of the white man. To the French trading posts on the St. Lawrence River had come Indians from various tribes, and among them the Hurons, "so called by the French because they wore part of their hair standing straight up like the bristles on a wild boar. Their own name was Ouendat or Wyandott".* From what he could learn of their location, numbers, state of culture and influence, Champlain concluded that it was desirable to cultivate their friendship. In the year 1613 he brought to Canada several missionaries, one of whom, the Recollet Father Le Caron, he sent to the country of the Hurons to establish a mission. Champlain's interest in establishing the Huron Mission was political as well as religious; he was setting up an outpost in furtherance of the cause of France in North America. Father Le Caron's purpose was to convert the savages to Christianity. In Champlain's view it was equally important to control the Huron fur trade, and to win the Hurons to side with the French against the English. Thus, in September 1615, he not only visited the Huron Mission with gifts of persuasion and good-will, but even accompanied a Huron war-party on an expedition against the Iroquois.

The expedition ended in disaster for the Hurons. Setting out from Cahiagué, at or near the present Orillia, the war party paddled down the Trent River to Lake Ontario and crossed over into the enemies' territory. They were repulsed, and late in October returned to Cahiagué, nursing their resentment. Champlain remained with them through the winter.

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* James, C.C. The Downfall of the Huron Nation. O.H.S. P. & R., VIII: 314, 1908.
According to Harrap's Dictionary, the word "hure" means: (a) a shaggy, tousled head; (b) the head of a boar.

From the western shores of the Penetang peninsula one could look out across the waters of Nottawasaga Bay to where the massive outline of the Blue Mountains showed like a barrier against the setting sun. The mountains, Champlain learned, were the western limits of the Huron territory; beyond them lay the Tobacco Indians, whose country reached to a great lake still farther to the west. "The Tobacco Nation was so called because they were growers of that article. Their Indian name was Tionnantates, their French name Petun."* Champlain determined to visit them.

Accordingly, in January 1616, Champlain and Le Caron, accompanied by their interpreter, Étienne Brulé, set out on their visit to the land of the Petuns. There is no record of the course of their journey, but it is said that they visited seven Petun villages and that they received a warm welcome. And this is, so far as we know, the first time that a white man set foot in the country that is drained by the Saugeen River.

> The Petuns "lived at peace with their Huron and Algonquin neighbors and cultivated the arts of peace so assiduously that by the middle of the seventeenth century they had attained a much higher point of wealth, prosperity and civilization than any of their kindred people. They found their country particularly adapted for growing and curing tobacco and made this, after the raising of Indian corn, their chief industry". †

In May 1616, Champlain returned to Quebec. He left behind him in the west a situation tense with the rancour of smouldering rivalry that was thirty years later to break out into a savage war of extermination. Champlain's share in the Huron expedition against the Iroquois had stirred in the latter a sense of bitter hostility. The Huron monopoly of the fur trade and the increasing scarcity of beaver furs in the

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* James, C.C. Op. cit., p. 314. The name Petun for tobacco is derived from a South American word for that plant. Petunia is a further derivative.

† Bruce, G.W. The Petuns. O.H.S. P. & R., VIII: 35, 1908.

Iroquois country brought dissatisfaction and hatred into the Iroquois councils. Their efforts to persuade the Hurons to share the fur trade proved ineffectual, The trade increased; the Hurons prospered; and the Iroquois determined grimly to destroy the Hurons. The storm of their fury broke in the winter of 1648-49, when "a large band of enemy warriors infiltrated into the Huron country and with masterly strategy isolated and destroyed the settlements one after another".* In vain the French missionaries sought to show the Hurons their danger and to persuade them to prepare their defences. The Hurons lacked the political acumen of their enemies; they not only failed to match and meet the strategy of the Iroquois, but even, by ill-advised and ill-directed raids on the country of the Ojibways and Ottawas, estranged those tribes that were by tradition and treaty their friends.

By 1649 the Iroquois had completely devastated the Huron country and had driven the remnants of the Hurons and all their allies out of the Huron peninsula.

> "Having dispersed the Hurons and their neighbours the Tobacco Nation, the Iroquois next destroyed the Neutrals, and then turning their attention to the Eries on the south side of the lake, blotted out that people and thus made themselves master of the whole country formerly divided among the different members of the great Huron-Iroquois family. When the Huron Mission was started in 1634 there were Hurons, Petuns, Neutrals, Eries, Andastes, and Iroquois; in less than a quarter of a century only the Iroquois were left. In this short time one of the great tragedies of the human race had been wrought and people after people had well nigh been wiped off the face of the earth."†

On the maps of the ensuing century the former Huron country is designated merely "the beaver hunting grounds of the Iroquois".

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* Kidd, K. E. The Excavation of Ste. Marie I, p. 13.

† James, C.C. Op. cit., p. 325. The Neutrals, occupying territory between that of the Petuns and Lake Erie, were so called because in the long wars between the Hurons and the Iroquois they took no part. This neutrality did not save them from extermination at the hands of the Iroquois.

The wretched remnants of the Hurons fled across Georgian Bay to the country about Lake Superior, and appealed to their ancient allies the Ojibways and the Ottawas for assistance and revenge. The Ojibways listened, remembered their grievances, and were not persuaded. Two hundred years later, Kah-ge-ga-gah-bowh, a chief of the Ojibway Nation, writing under his anglicized name of George Copway, tells the story of this appeal.

> "At this time there lived the greatest of renowned warriors, Wah-boo-geeg, who dwelt at Pequakqua-wah-ming. His name has been handed down from generation to generation, and his bravery and fame been envied by all young warriors.
> "It is said that this Wah-boo-geeg arose in the council with his club in his hand, and remembering the Hurons and their many barbarous acts, shook the war club over their heads, and said it was not fear which had led them to give them such a reception, but it was pity for their innocent children that induced them to open their arms and receive them. He told them that henceforth none should molest - that their children and the children of his own people should sport together - that the war club of the Ojibways should protect them - and that they were as numerous as the leaves of the forest, towards the setting sun."*

While the exiled Hurons continued to plead their unpromising cause with the Ojibway chiefs, the Ojibway hunters prosecuted a lively trade in furs with the French at Montreal. About the year 1652, the Iroquois, who resented the protection that the Ojibways had extended to the Hurons, attacked and murdered several Ojibway trading parties at various points along the French River - Ottawa line of communication. The Hurons seized the occasion to renew their arguments for revenge against the implacable Iroquois. The immediate result, however, was not war, but a Council of Peace, in which Ojibways met Iroquois in Iroquois country at the mouth of the Saugeen River, and there concluded a treaty of peace which, according to Copway, the Iroquois did not intend to keep.

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* Copway, George. Traditional History of the Ojibway Nation, pp. 79-80. Boston, 1851. The present Pequaming lies on the south side of Keweenaw Bay. A little to the east of this spot is Huron Bay, location assigned to the fugitive Hurons.

At this time the Hurons began to accompany the Ojibway traders to Montreal. This became added provocation to the Iroquois who saw "that the French were more friendly to the Indians of Lake Superior than they were to them; and that the Ojibways were a protection to those by whom they were formerly molested".* The treaty was broken, and once again the Iroquois attacked a party of traders on the Ottawa River.

What the Hurons had been unable to achieve by their persuasions, the Iroquois had brought about by their perfidy. The Ojibways determined to make a war to the death against the Iroquois, and the remaining Hurons welcomed the opportunity to seek revenge. To a dozen tribes the call went out, dwellers by the shores of Lakes Superior, Huron, and Michigan; and from the north and west and south the allies of the Ojibways answered the call. When all was ready, a fleet of no less than seven hundred war canoes gathered on Lake Huron and struck the enemy with overwhelming force.

The first fierce battle took place, ironically enough, at the mouth of the Saugeen River, at the scene of that Council of Peace where the treaty had been concluded whose violation was the cause of the war. It was now the turn of the Ojibways to carry raid after raid into the Iroquois' country. Battles were fought on Lake Simcoe, at Rice Lake, at Mud Lake, at Pigeon Lake, and at the mouth of the River Trent. This was another "war of extermination", and with varying intensity it continued through nearly forty years. Indian wars on a large scale were no swift campaigns. They had a beginning, but no apparent end.

The Ojibway-Iroquois war could not be waged apart from the alliances of the contestants with the French and the English. Denonville, the Governor of Canada, proposed in 1686 the establishment of two French posts, one at Detroit and the other at Toronto: "These two posts will block the passage

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* Copway, George. Op. cit., p. 85.

against the English should they attempt to go again to Michilimaquina, and serve as retreats for our Indian allies either while hunting, or while making war against the Iroquois". Governor Dongan, of New York, sent a succession of trading expeditions "with a large party of sixty men" to buy furs at "Missilimakina", and the French disarmed the second of these expeditions and allowed the Indians and French to pillage their goods. So far as Ontario was concerned, hostilities came to at least a temporary end in 1687, when Denonville led a war party of some four hundred canoes against the Senecas, cleared the north shore of Lake Ontario of the last of the "castles" of the Iroquois, and built a fort at the mouth of the Niagara River.

Between the French and the English, and between their respective allies, the struggle went on; but in this struggle the Huron peninsula no longer played a conspicuous part. The events of the eighteenth century affected Boston, New York, Quebec, Montreal, Albany, Niagara, and Detroit; but from the Saugeen country there were no reports and no news. Even the fall of Quebec in 1759 and the ensuing transfer of all French territory in Canada to the English gave no occasion for any mention of the remote region between Georgian Bay and Lake Huron. When the Saugeen reappears in written records we find it a country occupied by settled bands of Ojibway (Chippewa) Indians, or of their allies, the Mississaugas, the Pottawatamies, and the Ottawas. The tribal wars of the Indians have passed, some into legend, some into history; and an era of permanent occupation, settlement, and survey by the "English" of Upper Canada has begun.

CHAPTER 2

SETTLEMENT

In 1791 Canada was divided into the two provinces of Upper and Lower Canada. Within the next ten years, the lands bordering the St. Lawrence River, Lake Ontario and Lake Erie had been laid out in counties, and more than a hundred townships had been named and surveyed in the chequer-board pattern that the Government had adopted. The significance of Lake Huron as the western boundary of Upper Canada was recognized, and communications with its vast extent had been established by way of Lake Simcoe and Georgian Bay as well as by way of Lake St. Clair. Of the lands that lay between Burlington Bay and Lake Huron little was known until after 1820. In 1792, the surveyor Augustus Jones carried an exploratory expedition into the country traversed by branches of the Grand River, with instructions to run a line "from the outlet of Burlington Bay, W. end of Lake Ontario, to the River Thames, formerly called the River La Tranche". His course from Burlington Bay ran north-west for fifty miles, bringing him to a point less than two miles short of the present village of Arthur; here he turned south-west, and then south in his search for the Thames. Jones had missed the Saugeen by eleven miles.

The surveyors explored one by one the rivers of Upper Canada, and laid off townships along their several courses. Between 1791 and 1797, most of the Thames and Grand Rivers had been traversed. In 1804 William Hambly surveyed the "Chaniel Ecartie", the Sydenham River of South-western Ontario. Between 1827 and 1835, Mahlon Burwell, John McDonald, and David Gibson opened the Huron Road from the present New Hamburg to the mouth of the Maitland River, now Goderich, laid out townships on both sides of the road, and ran the line that divided the Canada Company Tract from the vast blank space to the north, marked "Indian Lands".

During the War of 1812 there were only two posts on Lake Huron that were regarded as of sufficient importance to call for fortification, namely Michilimackinac and Matchedash Bay. Vessels of both sides sailed the waters of Lake Huron, but appear to have had no occasion to put in at the mouth of the Saugeen River. Indeed, it is probable that few, if any, of the navigators of 1812-15 were aware of the existence of the Saugeen. Very literally, the Saugeen was not yet on the map.

It was in 1822 that Captain Henry W. Bayfield of the Royal Navy made the first survey of the upper Great Lakes and prepared the first chart of Lake Huron. The chart shows the mouth of the Saugeen River and its course (with no great attempt at accuracy) for a distance of two or three miles inland. Near the mouth, on the north bank of the river, Bayfield shows a small village, marked "Indian Traders". But he is chiefly concerned with the interests of navigation; the legend reads: "River Saugink, 6 feet over the bar it becomes shoal and rapid 200 fms. within the entrance". Nearly thirty years later, in the late autumn of 1850, the surveyor Robert Lynn observed the effects of a severe storm on the mouth of the Saugeen, and wrote in his diary:

> "examined the Mouth of the River, and came to a candid conclusion that the Mouth of the River Saugeen were Impracticable for making a permanent Harbour, at any reasonable expence."*

In the meantime,. the people of Upper Canada had begun to display an interest in the spiritual welfare of the Indians in various parts of the province. Missions were established at the mouth of the Credit River, at Muncey Village on the Thames, and in the vicinity of Detroit. In 1829, the Rev. Peter Jones (son of the surveyor, Augustus Jones, and of

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* Lynn, Robert. Diary of Survey, Southampton Town Plot. Ontario Dept. of Lands & Forests, Survey Notebook No. 1764.

Tubenahneequay, his Mississauga wife) was one of a party of seven preachers who visited the Saugeen Indians, "from whom they first heard the Gospel". Two years later the Canada Conference (Wesleyan) Missionary Society established a permanent mission at the mouth of the Saugeen River and placed John Benham, with John Simpson as interpreter, in charge. Arriving at his station April 19, 1831, Benham reported that he was "joyfully received by the few Indians who were here". A few days later, with the help and advice of the Indians, he set about building his house. He had brought with him by boat from Goderich boards for floors, and "doors, window frames and sash already made".

> "The situation is very pleasant and undoubtedly healthy, as it is near the shore of this rapid river and about a mile from the lake... Fish are abundant, such as sturgeon, salmon trout, pickerel, herring, white fish, bass and suckers. ...In short we could have almost every thing that renders life comfortable, if we had a team and tools, that would enable us to turn over the flats; and as for fodder we should not be at a loss if we did not cut any hay..."*

A month later, Benham wrote:

> "After consultation with the Indians, and all things being understood and mutually agreeable, we commenced clearing for a garden... The logs for our house were drawn with a rope which we found hard work. Having got our house up 18 by 24, we commenced school on the 16th of May. The Indians have cleared and planted 15 acres. Their living has been poor, as they raised little or nothing last year, their main dependance is fish. Our Indian society members are about 40, ten of whom have been added since our arrival here... The whole number that belong to this tribe is found to be 177, the greater part make it their home here, others are expected this season, other scattering families, and some from the other side of the Lake, are expected to settle here... You would be pleased with our situation, our house stands on the table land, above the extensive flatts, on the River about one mile from the Lake. The situation very much resembles that of the River Credit, only that we are on the North bank of the River. A beautiful spring opens near our house. The River moves briskly, but I think is navigable for boats. On the whole our commencement is favourable, though we know not what is before us, we are encouraged with prospects of usefulness to this poor people"...†

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* Benham, John. Letter to the Canada Conference Missionary society, dated April 30, 1831. Christian Guardian, May 28, 1831, p. 114.

† Benham, John. Letter, dated June 4, 1831. Christian Guardian, July 23, 1831, p. 146.

From this date forward, the Methodist missionaries, through their schools, through their preaching, and through their participation in the councils of the Indians, exerted a considerable influence on the lives of their charges. The Minutes of the Annual Conferences of the next twenty years give the names of the resident missionaries during that period and the numbers of Indian adherents.

Year	Missionary	Members *
1831	(not named)	40
1832	(no report)	
1833	John Benham	
1834	Thomas Herbert	55
1835	J. Armstrong	57
1836	Thomas Hurlburt	63
1837	John Simpson	70
1838	Gilbert Miller	70
1839	John K. Williston	65
1840	William Herkimer	81
1841	(not named)	107
1842	Thomas Williams	137
1843	George Copway	117
1844	George Copway	134
1845	George Copway	147
1846	John K. Williston	116
1847	John K. Williston	98
1848	John K. Williston	107
1849	John K. Williston	111
1850	William Herkimer	94

It has been previously noted that George Copway was an Ojibway Indian, and that Peter Jones, whose visit in 1829 led to the establishment of the mission, was born of an Indian mother. Herkimer and Simpson were also of Indian or mixed parentage.

The succession of appointments to the Saugeen Mission and the record of the numbers of church members afford little indication of the disturbing events of the year 1836. In that year the Lieutenant-Governor of Upper Canada, Sir Francis Bond Head, met the Ojibway chiefs in Manitoulin Island, and concluded with them the treaty by which all the Saugeen

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* Minutes of the Annual Conferences (1831-1850) of the Methodist Episcopal Church in Canada.

Territory south of the Owen Sound-Southampton line was ceded to the Crown.* The treaty consists of two separate agreements. The first called on the Ojibways and the Ottawas to relinquish their claims to "these Islands and make them the property (under your Great Father's control) for all Indians whom he shall allow to reside on them". With remarkable candour, Head declared the purpose of his Government in the following terms:

> "...as an unavoidable increase of white population, as well as the progress of cultivation, have had the natural effect of impoverishing your hunting grounds, it has become necessary that new arrangements should be entered into for the purpose of protecting you from the encroachments of the whites."*

The agreement was signed on the 9th August, 1836, by Head and his interpreter, and by fifteen Ojibway chiefs. The Governor then addressed his proposals for a second agreement to the Saugeen Indians who were present:

> "To the Saukings:
>
> "My Children,
> "You have heard the proposal I have just made to the Chippewas and Ottawas, by which it has been agreed between them and your Great Father that these Islands (Manatoulin), on which we are now assembled, should be made, in Council, the property (under your Great Father's control) of all Indians whom he shall allow to reside on them.
> "I now propose to you that you should surrender to your Great Father the Sauking Territory you at present occupy, and that you should repair either to this Island or to that part of your territory which lies on the north of Owen Sound, upon which proper houses shall be built for you, and proper assistance given to enable you to become civilized and to cultivate land, which your Great Father engages for ever to protect for you from the encroachments of the whites.
> "Are you, therefore, the Sauking Indians, willing to accede to this arrangement; if so, affix your marks to this my proposal.
>
> "Manitowaning, 9th August, 1836.
>
> "F.B. Head
> "Metiewabe (totem)
> "Alexander (totem)
> Kaquta Bunevairear
> "Kowgisawis (totem)
> "Mettawansh (totem)
>
> "Witness:
> "T.G. Anderson, S.I.A.
> "Joseph Stinson, Genl. Supt. of Wesleyan Missions
> "Adam Elliott
> "James Evans
> "F.L. Ingall, Lieut. 15th Regt. Commandg. Detacht.
> "Talfourd W. Field, Dist. Agent†

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* Canada, Indian Treaties and Surrenders. Ottawa, 1891. Vol. I, p. 112.

† Ibid., Vol. I, p. 113.

The conclusion of this treaty was the subject of an outburst of protest. An organization in England, the Aborigines Protection society, headed by Lieutenant-Colonel Sir Augustus D'Este, on April 10, 1837, presented a memorial to Lord Glenelg, Secretary of State for the Colonies, to point out to him the injustice of depriving the Indians of their homes and to petition against making their removal compulsory.

> "The Tract of Land so ceded is not solely inhabited by wandering and uncivilized Indians, but it comprehends within its Limits a thriving and highly interesting Wesleyan Missionary settlement, in which Two Hundred Indians have embraced Christianity, and applied themselves with success to the Arts of civilized Life; sixty of their Children are receiving regular Instruction in the Missionary school... It appears to your Memorialists that those Indians who have cleared the Land, ploughed and sowed Fields, and reared Houses, Barns, and Places of Worship, upon it have rendered themselves Possessors of the soil by a stronger Title than that by which their wandering Brethren have held other Portions of the District as a common Hunting Ground; and your Memorialists implore that these Indians may not be considered as bound by the Treaty and compelled to remove, but that they may be allowed, and even encouraged, to retain a Portion of the Land adequate to the Necessities of the Settlement, with the Privileges and Advantages equivalent to those offered to pauper Emigrants from this Country, who have yet to make the Land their own by Labour bestowed upon it...".*

The Memorial bore the signatures of eighty-two members of the Society, and was accompanied by two extracts from a letter written by the Wesleyan missionary, James Evans.

> "It was...proposed to the Chippewas from Saugeeng that they should relinquish all Title to their extensive Territory on Lake Huron, retaining only the Peninsula between the said Lake and the Georgiona Bay, the Line to commence at Bottom of Owen's Sound and to extend directly across the Peninsula. Thus the Indians are again more removed from the Spot to them dearest upon Earth, and constrained to give place to those, who receiving greater Encouragement, make consequently greater Improvement... . Never, I believe, have any Body of Indians relinquished their Claim to Lands in the Manner which the Saugeeng Indians have done...".†

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* Copies or Extracts of Correspondence between the Secretary of State for the Colonies and the Governors of the British North American Provinces respecting the Indians. House of Commons (London, England), 1839, p. 98.

† Ibid., pp. 99-100.

> "The Indians at this Station have been remarkable for their stedfastness since they embraced Christianity; they appear to be a happy people, much attached to their Missionaries, teachable, and give several solid Proofs that they are progressing in Civilization. What effect their Removal from this Spot so dear to them may have upon their future Conduct I cannot possibly predict; but surely, should they not make all that Improvement which some might expect, it should never be forgotten that to their frequent Removals, and the uncertain Tenure by which they hold their Lands, may chiefly be attributed their Neglect of agricultural Pursuits. They say, and not without some Provocation, 'If we clear Fields, build Houses, and make Orchards, the White Man will soon want them, and he must have them.'"*

Lord Glenelg's reply to this memorial, in spite of his concern "for the Benefits of those Tribes" and his "anxious Wish to adopt any Measures which might be necessary for their Protection and Civilization", was not encouraging.

> "He feels, however, that until you have had an Opportunity of considering the Grounds on which Sir F. Head adopted Conclusions in respect to the Treatment of the Indians so opposite to those expressed in your Memorial, it would not be possible for his Lordship to act on the suggestions submitted to him. He therefore directs me to enclose to you a Copy of sir F. Head's Despatch on this subject, the Perusal of which will probably afford you some new Information in regard to the serious Difficulties by which the Question is beset".†

The Conference of the Wesleyan Methodist Church, meeting in Toronto, June 24, 1837, maintained that the Saugeen Territory had been surrendered by persons who were not the proprietors, and declared further that it was the "deliberate and unanimous decision of the Chiefs assembled from different Tribes that no person should have authority to cede or surrender the Saugeeng Tract without the sanction of a General Council and the concurrence of the hereditary and acknowledged Chief".** They considered the surrender to be void. Glenelg asked Sir F. Bond Head to answer the charges made in this second memorial; and with Head's reply the correspondence closes:

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* Ibid., p. 100. † Ibid., p. 100. ** Ibid., p. 152.

"The proposed Surrender having been previously explained by me to the Chiefs of the Saugeen Territory, as well as to their Methodist Ministers, it was again formally proposed to them by me in Presence of the assembled Chiefs of all the Tribes at the Council, at which several of the best Orators were present. The proposed Arrangement was then not only again verbally explained by me, but I also explained to the Council that we White People had the Power of placing our Words on Paper; that to prevent any Mistake hereafter I would make their Interpreters translate aloud what I had that Morning written, in order that the Chiefs might judge for themselves whether or not it accorded with what I had just said; and that for further Security I had prepared One Copy to be kept by me, and One Copy to be kept by them.

"The subject was then discussed and agreed to, without a Single Chief or Warrior of any Tribe whatsoever raising the slightest Claim to the Saugeen Territory.

"The Saugeen Chiefs (at the Public Council, which was concluded by my formally smoking with them the Pipe of Peace,) made their Marks or Signatures to the Surrender, to which a Wampum was affixed; and when all these Formalities are compared with what has been asserted in the Memorial, your Lordship will be surprised to learn that the Methodist Ministers who were present during the whole Ceremony actually affixed their Signatures to the Surrender as Witnesses of the Solemnity of the Transaction".*

In spite of the protests, the treaty remained in effect, and was followed, in course of time, by further surrenders of Indian lands to the Crown and the vast forest that stretched to the northward from the line of the Canada Company's Huron Tract came to be called the "Queen's Bush".

Following the acquisition of the Saugeen Territory by the Crown, the most urgent need of the area was for roads of access. In his treaty-making address to the Indians, Head had referred to the land-hungry whites, who "seek for uncultivated land as eagerly as you, my red children, hunt in your forest for game...uncultivated land is like wild animals, and your Great Father, who has hitherto protected you, has now great difficulty in securing it for you from the whites, who are hunting to cultivate it". To meet this demand, and to place the land at the service of the would-be settlers, the Government

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* Ibid., p. 150.

must do two things: first, open roads; and second, survey the land into farm lots.

Hitherto, access to the Saugeen country had been by one of two routes, the Georgian Bay and Lake Huron. Since Champlain's day, by these waters had come explorers, traders, and missionaries; and now to these were added surveyors, land agents, and intending settlers (who anticipated the surveys and "squatted" on the lands of their choice). The Rev. Peter Jones and his party of evangelists, in 1829, had crossed Georgian Bay from Penetanguishene to Owen's Sound, had carried their boats and supplies across the Saugeen Peninsula*, and after a brief sojourn at the mouth of the Saugeen River, had gone on by Lake Huron to Goderich and Lake St. Clair, and thence to Toronto. Upon Mr. Benham's appointment in 1831 to the infant mission at Saugeen, he and his interpreter had travelled from the Credit River to Stratford and Goderich, and thence by water to Saugeen. No land route was yet available; to open a good and direct road was a matter of immediate urgency.

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* Jones, Rev. Peter, Life and Journals, pp. 236. "Tuesday 21st (July 1829) Early this morning we crossed the bay, which is about eight miles wide; and on the 22nd, having taken an early breakfast, we set off to cross the portage to Lake Huron. Two men carried our large canoe, and another carried the small one. The rest of our party carried our provisions, clothing, &c. The first portage is about three miles long. We then came to a small lake. After crossing this in our canoes, we came to the second portage, about a quarter of a mile in length. We then came to a second lake, and then again to another portage of a half mile long, which brought us to the main Lake Huron. We went to an island and took some refreshment. There are several islands here, and they are called by the Indians Okaquahneeseshahning, the place of the Herring Fish. At 3 p.m., we left these islands, and by sunset we landed at the River Saugeen - the mouth of the river. Here we found two camps of Indians belonging to the Ojebway nation. There were about 25 persons in all. On landing, we found the men sitting on a log near the water. We went and shook hands with them, and they appeared glad to see us. We slept on the beach for the night...".

The Government instructed Charles Rankin to lay out the line of a road "from Oakville to Owen's Sound". Mr. Rankin in 1833 had laid out the Townships of Collingwood and St. Vincent, on Georgian Bay, and by his choice of a site for his own log house at Lora Bay, just west of the present village of Thornbury, had become one of the pioneer settlers of Grey County. Beginning at the head of Owen's Sound, in 1837 Rankin ran the line of his road through to Garafraxa Township. His report states:

> "Of the first part of this route, vizt., from Oakville to Garafraxa, being already established & known, it may be sufficient here briefly to remark that from the circumstance of the rise of country from Lake Ontario being so gradual as to be almost imperceptible, the line appears on that account a particularly favourable one.
>
> "The route proposed by the inhabitants of Garafraxa in continuation through that township keeps a good deal to the southward of a direct line, for the purpose of avoiding the great 'Luther Swamp' - a swamp of which it may be observed that, lying very high & being exceedingly extensive, it appears as a grand reservoir supplying by its springs the principal rivers of each of the three large Lakes - Ontario, Erie, and Huron...".
>
> "It is also suggested that if a Sleigh road were opened along this line (the expence of which would be but trifling) and a tier of lots laid off on each side & granted to actual settlers, that the settlement of the neighboring country might thereby be much promoted...".*

The Rebellion of 1837 interrupted Rankin's operations, and the greater part of the line he had blazed was never opened. When, in 1840, the Government took the next step toward providing access to the Saugeen Tract, it was to instruct John McDonald to undertake the necessary survey. But there was much delay, and it was more than two years before McDonald was able to begin his work, and then only on the verbal instructions of his superiors. His report of his operations makes it clear that he did not hesitate to disregard Mr. Rankin's line, and that he depended wholly on his own judgment in deciding where the

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* Rankin, Charles. Ontario Department of Lands & Forests, Surveyors' Letters, Rankin, No. 82.

Old church on west side of the Toronto-Sydenham Road (Highway No. 10), near Berkeley, in Holland Township.

Anglican church at Durham, built 1878.

road should be made.

> "I spared no pains or labors in making the best possible selection of ground...I had not only Swamps to contend with, but also in various places very broken surface, occasional groups of hills and knolls, intermixed with hollows and pits of various descriptions...".*

> "The road was 'brushed out' in 1842, but in spite of the efforts of the Government to induce settlers to come in, by promising to build bridges and 'corduroy' through the swamps, little was done except for about fifteen miles at either end. This left the centre which passed through what was long known as the forty-mile swamp, entirely without improvement...".†

The Garafraxa Road was a "free grant" road. That is, the Government offered as an inducement to settlers fifty acres (half a lot) free to each bona fide settler, with the option of buying the remainder of the lot within nine years. At first the vacant half-lots alternated with the occupied half-lots, and all faced the road in a single tier. As a result, the settlers were spaced farther apart than they liked; and it became difficult to maintain the road in front of the vacant half-lots. As further work was done on the road, the Government changed its plan, and in Glenelg and Bentinck Townships located the pioneers on all the half-lots facing the road, giving them the usual option to buy a contiguous half-lot in a second tier. The Garafraxa Road became the chief route by which settlers entered the Queen's Bush.

> "The clearings on either side became more numerous, taverns, or stopping-places, sprang up along the way, and the hamlets through which it passed began to take the form of thriving villages...".**

In their choice of a site for their pioneer

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* McDonald, John. Ontario Department of Lands & Forests, Surveyors' Letters, McDonald, No. 147. McDonald followed Rankin's line from the north-west angle of Garafraxa to the crossing of Fairbanks Creek three miles north-west of Mount Forest. From that point to Owen Sound, Rankin's line runs from one to three miles to the west of the present road (McDonald's line).

† Marsh, History of the County of Grey, pp. 236.

** Ibid., p. 238.

homes, many settlers were guided by a desire to "locate" in the proximity of good neighbours, and no farther than was necessary from the more settled communities they were leaving behind them. Thus the tendency was for settlement along the road to develop progressively from either end and to build up at intervals the beginnings of the hamlets and villages referred to in the passage quoted above. Such a village was Mount Forest, called at first "Maitland Hills" because of the erroneous supposition that the stream on which it was situated was a branch of the Maitland River.* Such also was Durham, founded by Archibald Hunter in 1842. Hunter had emigrated from Scotland in 1841 and had settled in New York State. Attracted by the offers of free grants to be had in Canada, he and his son William made their way to Oakville, and thence by the Garafraxa Road into the wilderness. At Oakville they were advised to "locate" on the high land that they would find immediately north of the crossing of the "Big Saugeen River". This then became their pitch: Mr. Hunter chose his land on the east side of the road and William took the lot opposite. The first building erected in Durham was Archibald Hunter's log house, in which he passed the winter of 1842-43. Within a year he had brought his family to the new home, and had opened his house to the public as an inn; there was then no other inn between Mount Forest and Owen Sound. In 1854 Hunter built the stone hotel which was described in 1920 as

> "a hostelry which contrasted strongly with the average wayside log public house, since it was built of well-mortared and well-laid material, as solid and immovable in the building today as when it was placed there probably 70 years ago".†

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* Rankin had been correctly informed of the relation of this stream to the Saugeen, and marked it on his plan of 1837: "Southern or Main Branch of the Saugin R.". McDonald, in 1841, was misinformed, and marked on his plan at this point: "This Stream is supposed to be the Main Branch of the Riv. Maitland". On McDonald's plan a later hand added: "Since ascertained to be the South Branch of the river Saugeen". Ontario Department of Lands & Forests, Plans Nos. P14-14 (Rankin) and P14-22 (McDonald).

† Spencer, Rev. P.L. "Ship and Shanty in the Early Fifties." O.H.S. P. & R. Vol. 18, p. 27.

The British Hotel, Durham, built in 1854 by Archibald Hunter (from a photograph made in 1858).

This was the corner-stone in the original grist mill built by David Winkler, in 1857, in Neustadt, on Meux Creek. It now forms (1952) part of the foundation of a modern flour mill on the same site.

Memorial cairn, at Durham, marking the spot where the first settler, Archibald Hunter, passed his first night, May 1, 1842.

It soon became desirable to open additional roads to the Saugeen, partly as avenues of access, partly as, in themselves, the basis of settlement schemes. In 1848 Charles Rankin began to survey the Toronto-Sydenham Road through the townships of Artemesia and Holland; and in the same year David Gibson and Allan Park Brough laid out the Durham Road, an east-west line crossing the Garafraxa Road at Durham, and extending ultimately to Lake Huron at Kincardine. Both these roads were "colonization roads," laid out with the intention of making free grants of half-lots to actual settlers, with the option of buying the remaining half-lot; and along both roads the new-comers continued to "locate", while at intervals hamlets grew into villages, and villages into towns. On the Durham Road, Abraham Buck settled at "Buck's Crossing" (now Hanover) and opened his log house as an inn; and Joseph Walker opened an inn at another crossing of the Saugeen River, the beginning of the present town of Walkerton.

By 1850, the stream of traffic over the Garafraxa Road had become very heavy. In the words of W.H. Smith:

> "Post offices are established along the line, and considerable improvements are making. Five thousand five hundred pounds have been expended on the road, but this is a very small sum for such a length of road, and one so much travelled, and much larger sums will be required before it can be put in proper order; the traffic on it is considerable, and we were informed by a gentleman holding an official appointment in the county, that having occasion to travel along the line when some new lands were opened for sale, he remarked that the tavern at which he was accustomed to put up, was in considerable confusion, and neither so clean nor so tidy as he usually found it. On mentioning the circumstance to the landlady, she accounted for the state of affairs by remarking that during the week two thousand persons had stopped at the house...".*

The improvement of the road by gravelling was begun about 1857 and was continued until the whole was gravelled in the course of the next ten years.

Beginning about 1850, travellers found that they could effect an economy in time and effort by going along

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* W.H. Smith. Canada: Past, Present, and Future. Toronto, Maclear, 1851. Vol. II, p. 112.

the Durham Road to Buck's Crossing, and there building themselves rafts or scows by which to continue their journey by water. One of the first to try the water route was Robert Lynn, the surveyor who was instructed to lay out the town plot of Southampton, then called Saugeen. He records the manner of his journey in his survey diary:

> "1850: Monday, 14 October - Travelled with our Team from Hunter's Inn in Durham, to the crossing of the River Saugeen in the Township of Bentinck, 11 miles, very bad roads after the heavy Rain... Tuesday 15 - Travelled up the Southern Branch of the River Saugeen, for Scow-boat, and brought her down the River to the Durham Road in the forenoon...Repaired the Scow-boat in the afternoon, which were 30 feet long & 6 feet Broad. Wednesday 16 - In the Morning made Oars and Seats, purchased Potatoes, and loaded our Scow-boat, and Rowed down the River to Walkers by the River 15 Miles, and put up for the night, foggy and thick.
> Thursday 17 - Rowed from Durham Road at Walkers, to near Mud Creek, down the River Saugeen. Made a fire, took our Lunch and encamped for the night, at midnight made up a fire, fine weather. Friday 18 - Rainy Morning, made Breakfast. Reloaded and rowed down the River. rain continued went ashore about Midday and took a lunch after making a good fire, dried ourselves a little, and started our journey, when opposite the Indian Village, loaded & fired a Volley, & Rowed to the Mouth of the River Saugeen, on Lake Huron."*

In the course of the next two or three years, the river journey by scow or raft became a fairly frequent undertaking; and the experience was occasionally a much more exciting affair than was Lynn's voyage. In the hands of inexperienced farmers or woodsmen, a scow could prove to be a cranky craft, and a raft of cedar logs a most ungovernable contraption. Some grounded in the many shallows and had to be lightened by throwing overboard a part of the treasured cargo; some were wrecked, and their crews had to be rescued from a river they had not yet learned to navigate; and a few were drowned. Lynn himself, having returned to Toronto during the winter of 1850-51, witnessed the wreck of a scow on his second trip down the Saugeen in April 1851.

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* Lynn, Robert. Survey Diary. Ontario Department of Lands & Forests, Survey Notebook, No. 1764.

"Tuesday 22nd, Wednesday 23, & Thursday 24th - Got the Lumber cut out, prepared, and Scow-boat made.
Friday 25 - Calked the Boat, turned her over & Launched her in the River, stopped the Leakages, made seats, and pins to fit the oars in, then made Four Oars to pull with and two large end Oars to Steer the Rapids & diverge past Large Boulder Stones.
Saturday 26 - ...Rowed from Walker on the Durham Road, down the River, about 15 Miles...got down to Mud Creek, and put up for the night on the River Bank in a half made Shanty...
Sabbath 27 - ...commenced our journey, when about 12 miles above the Indian Village, heard a loud calling, and rounding a bend of the River, came in sight with a Scow-boat sunk, in the Centre of the River, with three Men, two Women, & several Children, being ahead myself with the long diverging Oar, I called out to the man on the Stern for us to Board them, as care-full as possible, when comming near them the current run very rapid, I Steered for their quarter, and slightly grazed the first angle of our Scow-boat, but the man at the Stern Oar saw a Danger, and evaded my striking them, our speed being Rapid, one man jumped on our Scow-boat, and we went swiftly down the current, and at the bottom of the rappid, we landed on the east shore and enquired what were best to be done, the sunken Scow were in about 3 feet of Water fast on the bottom, amongst the stone boulders, the people were sitting upon the furniture & Boxes, I consulted my party and desired that we should unload our Scow, and board them if possible, they answered me that it were impossible for the men I had to take the Scow against the current above them, and that it would be the best to make our way to the Indian Village or some squatter to come as quick as possible upon a small raft or in a Canoe, we then gave the man a few matches to make a fire, and set off down the River, about 4 miles below we landed at a Shanty, were they were two stout young men, and one went to were they were some Relations of some of those on the Sunk Scow-boat, and they gave warning to several squatters on the bank of the River, the other young man went with us to the Indian Village, were we informed the British Missionary, who promised to send a couple of Indians, and then proceeded to the Mouth of the River."*

There were now the following routes by which, singly or in combination, settlers were finding their way into the Saugeen

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* Ibid. The Mud Creek of the Diary is the present Teeswater River. The Indian Village was on the north bank of the Saugeen, about one and three-quarters miles from the mouth of the river. The "two stout young men" were the brothers William and David Kennedy, who themselves had come down the river by scow only seven days previously, and had erected their first log cabin on Lot 15, Concession VIII of Saugeen Township, on the east bank of the Saugeen River.

country.

1. Via Penetanguishene and Georgian Bay
2. Via Goderich and Lake Huron
3. Via the Garafraxa Road
4. Via the Toronto-Sydenham Road
5. Via one of these two, and the Durham Road
6. Via the Durham Road, and the Saugeen River

To keep pace with the numbers of settlers, it was necessary to lay out the lots to accommodate them...and to provide agencies for "locating" them. In 1848, the Crown Lands Office for the County of Grey was removed from Owen Sound to Durham and Mr. George Jackson was placed in charge as Government Land Agent. Not until 1851 was a similar appointment made for the County of Bruce. In that year Mr. Alexander McNabb was appointed Crown Lands Agent for Bruce and opened his office in Southampton. Some idea of the number and extent of the Government surveys in the vicinity of the Saugeen, undertaken between 1836 and 1855, may be gained from the following list of survey records deposited with the Surveyor General of the Province.

Year	Surveyor	Township, etc.
1836	Rankin	Euphrasia
1837	Rankin	Garafraxa Road
1841-2	McDonald	Arthur
1843	Dennis	Sullivan
1845	Kerr	Egremont & Normanby
1845	Vidal	Bentinck & Glenelg
1846	Rankin	Holland & Derby
1847	Wilkinson	Huron District (part)
1848-9	Gibson	Durham Road, east part
1848-50	Brough	Durham Road, west part
1850	Rankin	Toronto-Sydenham Road
1850	Rankin	Osprey & Artemesia
1850	Bridgland	Kincardine
1850	Brough	Brant
1850-1	Lynn	Southampton Town Plot
1850-1	Dennis	Bentinck & Glenelg
1851	Daniell	Egremont
1851	McPhillips	Elderslie
1851	Walsh	Greenock
1851	Rankin	Arran
1851	Vidal	Saugeen
1851	Brough	Bruce (part)*
1852	E.R. Jones	Kinloss
1852	Miller	Bruce (residue)

* Brough died in the course of the survey of Bruce Township, and his assistant, Latham B. Hamlin, brought the survey to an end. In 1852, as noted, Miller surveyed the remainder of the township.

County Registry Office for the Southern Division of Grey County, at Durham, built in 1871.

School house at Edge Hill, Lot 35, Concession III East of the Garafraxa Road, Glenelg Township, built probably before 1870.

Year	Surveyor	Township, etc.
1852	Daniell	Carrick
1852	McPhillips	Culross
1852	Rankin	Minto
1853	Savigny	Howick
1853	Gibson	Melancthon
1853	Gibson	Normanby
1853	Fraser	Turnberry
1854	Gibson	Saugeen River
1855	Gibson	Proton
1855	McPhillips	Luther

After the opening of the county land offices, the lands in their respective areas were offered for sale to those who should apply for them to the Land Agents. But throughout the entire Saugeen Tract there were hundreds of settlers who had selected their sites before there was any provision for such sale, and even before the lands had been surveyed. "To make good their claim as squatters and retain their rights to the land settled upon it was necessary to have their names entered as purchasers, make a first payment, and obtain a license of occupation...".* In Bruce County, it was decided to hold a sale of all remaining Crown Lands in the county, and the date was set for September 27, 1854, at Southampton. This event came to be known as the "Big Sale". On the day named, more than two thousand would-be purchasers were present, the accommodation of the village was taxed beyond capacity, whiskey was more plentiful than bread, and rivalry and general excitement ran high. In his "History of the County of Bruce", Mr. Norman Robertson quotes the following account from a paper written by John McNabb, son of the Land Agent:

> "The Crown Lands Agent stood at the window of his office and the money was handed up to him. So quickly did the bank bills roll in that he did not have time to count them, but threw them into a large clothes basket, and when the basket was full put a cloth over it. In two days upwards of \$50,000 in cash was thus taken in and \$8,000 in drafts. The strain on the agent was so great after some days that he was completely prostrated,

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* Robertson, Norman. History of the County of Bruce, p. 67.

> and Doctor Haynes would not allow him to do any more business for a week or so. In fact, if he had not taken the physician's advice his life would have been in danger. It may be added that two gentlemen volunteered to assist the agent, but they also succumbed to the strain and gave up..."*

Between the Free Land Grants along the colonization roads and the lands being sold by the Government at 7s. 6d. to 10s. per acre, it is not surprising that many ingenious and enterprising persons managed to secure control of more land than was allowable to an individual settler, and to carry on a highly profitable business of speculation. Robertson quotes, on this subject, a motion "passed at the June session of the Counties Council", part of which reads as follows:

> "as many of the settlers who have squatted upon the lands within the said townships are endeavoring by unjust means to obtain and hold possession of more land than is allowed by the recent Land Act to each settler, and thus preventing many other good and active settlers from obtaining land, and so materially retarding the progress and improvement of the said townships and the wealth and influence of these united counties, that the warden be instructed by the Council to represent the matter to the Governor-in-Council and petition him to have the lands within the said townships opened for sale at the earliest possible period...".†

In spite of the various delays, in spite of the speculators, in spite of the discouraging roughness of the roads (or their entire absence), and in spite of the hardships involved in the effort to convert the forest into homes and the wilderness into civilized communities, the process of settlement went on with astonishing rapidity. In 1851, the census returns indicated that the population of the entire Saugeen Watershed was 8,556. During the ensuing thirty years the population increased at an average rate of 2,600 persons per year, until by 1881 the same area contained 86,843 persons, occupying nearly 10,000 farms.

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* Ibid., p. 68.

† Ibid., p. 69.

Log house west of Irish Lake, Glenelg Township.

Stone farmhouse about two miles north of Durham, on the east side of the Garafraxa Road (Highway No. 6).

It is a simple matter to trace the course of the growth of population in the Saugeen in the early days of the development of that region. Settlers poured in by the thousands, and most of those who went into the area remained and made it their home. An examination of the accompanying diagram, however, will show that the course of growth reached its peak about the year 1881,* and that from that time forward the population began to decline. In the early years of the '70's, the Saugeen began to feel the effects of the opening of the prairie provinces, and the settlers who had hewed their farms out of the Queen's Bush hankered for a chance to try their hand at lands that required no clearing. What Robertson has to say concerning the County of Bruce is applicable to the entire Saugeen country:

> "The time was to come when Bruce would cease to be looked upon as a locality to which settlers might go in search of a home, and change to one from which emigration to new settlements might be expected. The latter period was certainly reached when a meeting was held at Southampton April 16th, 1875, the object of which was set forth in the following motion, which was duly carried thereat: 'That from the experience we have had as settlers in the county of Bruce, we believe the system of settling by the formation of a colony is attended by less hardships and privations than many of us endured in the early settlement of this county; that being anxious to plant a colony in the province of Manitoba from the county of Bruce, immediate steps be taken to further this project, and that a suitable location be made as speedily as possible.' At this meeting 'The Bruce Mutual Colonization Company' was organized, and James Stirton was appointed to select a proper location in Manitoba. The movement so started proved to be the prelude to a large emigration, which has not (1906) ceased, of the most energetic and enterprising of each generation, as it appeared, until the western prairie land seems to teem with those who are proud to say that they come from the county of Bruce...".†

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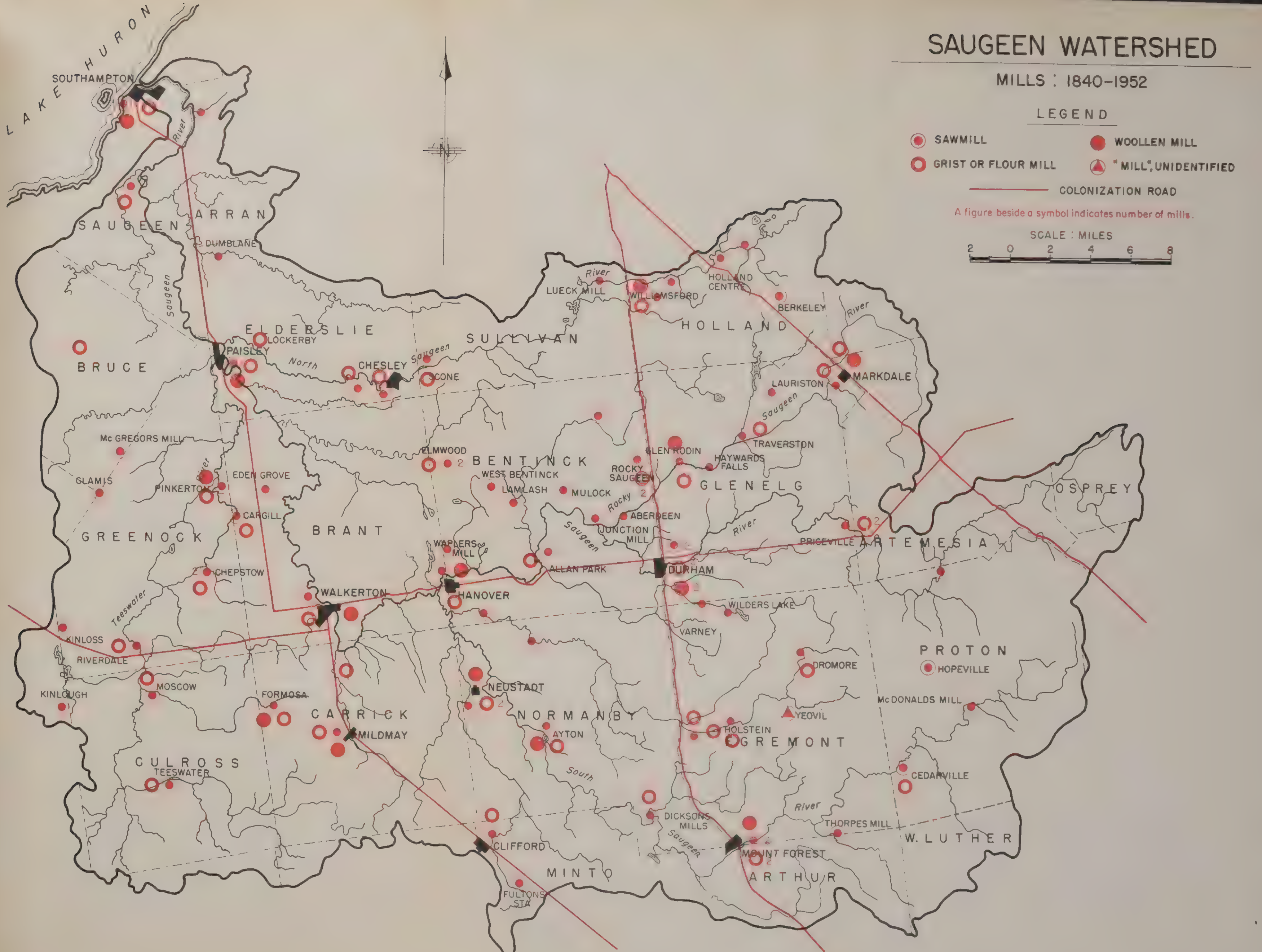
* This was the year of the decennial Dominion Census. According to the <u>annual</u> census returns published by the Ontario Bureau of Industries, the actual peak of population, in both Grey and Bruce Counties, was in 1879.

† Robertson, Norman. Op. cit., pp. 118-119.

The rapid increase of population to its peak in 1881 (or thereabouts), and its subsequent decline, are characteristic of the townships apart from their towns and villages. The trend within the separate municipalities, however, is much more difficult to analyze, each town and village exhibiting a pattern of its own. Nevertheless, some generalizations appear to be justified. Seven out of eight municipalities that appear in the census returns of 1891 showed an increase at that time over their populations of 1881. Ten out of eleven municipalities showed a decline in the decade 1911-1921, Hanover alone showing a conspicuous rise during the same interval. Ten out of twelve municipalities show an increase in population in the decade 1941-1951, Chesley and Teeswater having slightly decreased. It is evident that the migration to the prairies did not draw from the towns and villages to the same degree that it did from the rural areas, or, if it did, that the losses were more than balanced by the corresponding gains. It also appears that the towns (with the exception of Hanover) underwent a period of temporary decline between 1911 and 1941; and that this decline coincides with a period of similar decline in the township populations. Finally, it is evident that in the decade 1941-1951 the towns have gained in population, while the townships have continued to decline.


SAUGEEN WATERSHED
MILLS : 1840-1952
LEGEND
SAWMILL
WOOLLEN MILL
GRIST OR FLOUR MILL
"MILL", UNIDENTIFIED
COLONIZATION ROAD
A figure beside a symbol indicates number of mills.
SCALE : MILES
2 0 2 4 6 8
LAKE HURON
SOUTHAMPTON
River
SAUGEEN
ARRAN
DUMBLANE
Saugeen
ELDERSLIE
LOCKERBY
PAISLEY
North
CHESLEY
Saugeen
SULLIVAN
CONE
BRUCE
LUECK MILL
River
WILLIAMSFORD
HOLLAND CENTRE
BERKELEY
HOLLAND
River
MARKDALE
LAURISTON
Saugeen
TRAVERSTON
HAYWARDS FALLS
GLEN RODIN
ROCKY SAUGEEN
GLENELG
Mc GREGORS MILL
GLAMIS
PINKERTON
EDEN GROVE
CARGILL
ELMWOOD
BENTINCK
WEST BENTINCK
LAMLASH
MULOCK
Rocky
ABERDEEN
JUNCTION MILL
Saugeen
River
PRICEVILLE
ARTEMESIA
OSPREY
GREENOCK
BRANT
WALKERS MILL
ALLAN PARK
DURHAM
CHEPSTOW
Teeswater
WALKERTON
HANOVER
WILDERS LAKE
VARNEY
KINLOSS
RIVERDALE
MOSCOW
KINLOUGH
FORMOSA
CARRICK
MILDMAY
NEUSTADT
NORMANBY
AYTON
PROTON
HOPEVILLE
DROMORE
McDONALDS MILL
YEOVIL
HOLSTEIN
EGREMONT
CULROSS
TEESWATER
South
CEDARVILLE
River
THORPES MILL
DICKSONS MILLS
Saugeen
CLIFFORD
MOUNT FOREST
W. LUTHER
MINTO
ARTHUR
FULTONS STA.

CHAPTER 3

MILLS

The importance of mills in the development of early settlement in Upper Canada is well known. One of the settler's earliest needs was for lumber with which to build himself a house and a shelter for his cow, his ox, and his pig; and as soon as the first harvests had been gathered came the need for grist mills. Whenever possible the mills were operated by water power, and it was an important part of the instructions to surveyors to note and report all potential "Mill-sites".

> "Your field book is to be kept in the accompanying form, comprising ... all brooks and rivers, with their width, depth and course, rapids and falls, giving the estimated difference of level in feet, and stating whether they afford mill-sites, &c ..."*

> "Wherever a settlement is formed, it begins gradually to develop the usual features of an American village. First, a sawmill, a gristmill, and a blacksmith's shop appear; then a school-house and a place of worship."†
> "A saw-mill of itself soon forms a settlement; for attached to it must be a blacksmith's forge, dwellings for carpenters, millwrights, and labourers, stables, and ox-houses. A shop and tavern are also sure to spring up close to it; tailors and shoe-makers are also required."†

This account, written in 1833, might serve as well to describe any one of a dozen of the early settlements on the Saugeen in the 1840's and '50's. There must have been a lively demand for sawn lumber at Buck's Crossing (Hanover) in the days when settlers were building scows to carry themselves and their effects down the river in search of land. Robert Lynn was not a settler but a surveyor, on his way to lay out the Town Plot of Southampton, but his experience must have been that of many who were actual settlers and who travelled the same road in 1850 and 1851.

> "Saturday, 19 (April 1851) - Set men to work to cut timber for the sides & cross-braces for a Scow-boat 30 feet long & 6 feet wide and purchased Boards for the Bottom & ends from a Mr. Lundy which he had for

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* Survey Records, Lands & Forests, printed instructions to surveyors, 1851.

† MacGregor, John. "British America", 1833, pp. 501 and 548.

> flooring, at 12s per 100.
> "Monday, 21 - cutting out timber for the Scow-boat, they had borrowed a most wretched whip-saw, I ordered the log to be taken out of the Pit and bored with an Augur, And split it with large Wooden wedges, and self assisted to cut the cross and pieces &c ..."*

Yet at Buck's Crossing it was not until three years later, in 1854, that the first sawmill was built. In the course of those three years a considerable number of scows were built; houses were erected, roofed and floored; and the timber for several bridges was prepared. One hopes that the sawyers had better tools to work with than Mr. Lynn's "most wretched whip-saw"!

1. <u>On the Main Saugeen</u>

The earliest known mill on any part of the Saugeen stood at the mouth of a small creek that empties into the Saugeen River in Lot 28, Concession B, Arran Township, some four miles above Southampton. It had a short and unhappy career, of which the following are the essential particulars.

On the 3rd of April, 1844, Samual P. Jarvis, Chief Superintendent of Indian Affairs, in a letter to the Governor's secretary, Captain Higginson, laid before the Government the proposal for a mill.

> "The head chief of the Chippewa Indians residing at Saugeen has arrived at Kingston with the view to obtain permission to have certain buildings, etc. erected for the general use and benefit of the Tribe.....There is an eligible mill site on the land belonging to the Tribe and a saw mill will be a great service to the Indians and will amply repay the cost of its erection..."†

The mill was to cost £150. On May 20, 1844, Benjamin Miller of Goderich contracted

> "to build in a good and substantial and workmanlike manner a Saw Mill at Saugeeng aforesaid the dimentions of the Mill to be eighteen feet by fifty feet properly enclosed - and also to make the necessary excavation for the dam - The dam to be of logs and timber filled in with brush and gravelall the necessary machinery for the said Mill to be supplied

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* Lynn, Robert. Diary of Survey, Southampton Town Plot. Ontario Department of Lands and Forests, Survey Note-book No. 1764.

† This passage and those ensuing are excerpts from copies of letters supplied by the Indian Affairs Branch, Ottawa.

> and put in by the said Benjamin Miller - and the Mill to be finished and delivered over in good working order."

During the summer of 1844, the mill was built; on November 11 the Wesleyan missionary to the Saugeen Indians, the Rev. George Copway (himself a Chippewa Indian), wrote to Mr. Jarvis as follows.

> "I have got the saw mill this fall and have found men to cut saw logs for the Indians as soon as I found that the Indians would not cut and saw logs for themselves, sooner than to see this mill idle this fall as well as next spring.
> "I am sorry to see the Indians so reluctant in working the mill.
> "Please as soon as you can write to me that I may know what to do. I have got 150 logs cut for the mill and will have as much more this week and will not cut any more until I hear from you."

On November 18 Inspector Alex. Robertson reported his satisfaction with the manner in which the contract had been fulfilled.

> "Having examined the Saw-Mill, I found it perfect in every particular, the castings are of the best description and all the gudgeons turned, the Mill being put in operation it worked well, cutting a board of thirteen feet by fourteen inches in four minutes, with sixteen inches of water less than its proper head."

A month and a half later, the dam was washed out in a mid-winter freshet; and on April 7, 1845, the Indians appealed to the Superintendent to compel Mr. Miller to make the necessary repairs, alleging that they did not consider the work to have been done "substancially as it might have been". Mr. Jarvis wrote to the contractor to know whether he intended to repair the damage.

> "The Dam of the Saw Mill which you erected for them last year has given way at the North Corner and the Mill in consequence has been rendered useless to them.... It is apparent that the ends of logs with which the dam was formed were not sufficiently inserted and secured in the Bank, otherwise the water would not have worked a pass around them."

In his reply, Mr. Miller charged the Indians with neglect. "They did not raise the waist (waste) gates, and let the water overflow the dam. The dam can be made safe as near as I can understand in 3 days by 3 men." It does not appear that Miller ever made the repairs, or that the mill ever

McGowan's grist mill, on the site of the former Edge's Mill, first built in 1847.

McGowan's dam, formerly Edge's dam, on the main Saugeen River, at the east side of the Town of Durham. The first dam on this site was built in 1847.

ran again. The three hundred logs referred to by Mr. Copway probably represent the limit of what this mill may have cut. Within a year the mill had been destroyed by fire; thereafter it appears on the surveyors' plans only as the "ruins of Indian Saw Mill". Six years later, in 1851, Charles Rankin reported that the adjacent lots in Arran Township had "to some extent been culled by the Indians during the time they had a saw mill (afterwards burned) at the mouth of the little stream on Lot 28, a great portion of what remains is of an inferior quality".

Some time in the 1850's, Charles Sing (or Sang) is said to have built a sawmill at the same spot, and the little creek is now known as Sang's Creek.

It is worthy of note that, judging by the time required to saw a board "thirteen feet by fourteen inches", as reported by Inspector Robertson, the Indian sawmill of 1844 was apparently equipped with a circular saw, which by that time had begun to replace the less efficient upright saw.

Among the earliest mills on the Saugeen were the Edge Mills at Durham, built in 1847 by John Edge of Dublin, Ireland. These consisted of a flour mill, a sawmill, and a woollen mill. They not only supplied local needs, but also provided a surplus, especially of flour, for trade to other parts of the Province. From 1857 to 1871 the mills were leased to Mr. Edge's agent, John Kelly. In 1887 Edge's Mills were burned; in the following year they were rebuilt by Robert McGowan, and they remain in McGowan hands in 1952. The woollen mill was in the same building as the grist mill.

The "Durham Mills", located on the west side of the Garafraxa Road in Durham, included a sawmill (1853) and a flouring and oatmeal mill (1859). By 1865, a woollen factory had also been added, where custom carding and fulling were done.

At Hanover, the earliest mill was a sawmill, built in 1854 by H. P. Adams, who in 1855 also built a grist mill. The "Directory of the County of Bruce", 1867, lists in Hanover a grist and flouring mill, a sawmill, and a carding

and fulling mill. The sawmill disappeared from the records at an early date; the grist mill, familiarly known as the Old Red Mill, persisted through several changes of ownership until 1919, when it was destroyed by fire.

It was in 1850, the year that the Durham Road was chopped and the Saugeen spanned by a bridge, that Joseph Walker, the founder of Walkerton, took up the farm lots which were surveyed into town lots to provide the beginnings of that town. Two years later Walker erected a dam across the Saugeen River, and used the power thus obtained to operate a sawmill. In 1853 he added a grist mill. In 1871 the sawmill became the saw and planing mill of S. and T. H. Noxon and Co., and later was leased to R. Truax and Company. The grist mill was burned in 1864 and rebuilt in 1870; some time later it was again burned, and in 1886 again rebuilt by R. B. Clement as a roller-process flour mill.

There was in Walkerton another roller grist mill, on the west side of Silver Creek, operated by George Harrington, later sold to John Lee. For a time there was also a woollen mill, which in 1902 removed to Cargill. The "History of the County of Bruce" mentions also a flax mill and an oat-meal mill, operated by George Shortt, of which in 1906 only ruins remained.

TABLE I

MILLS ON THE MAIN SAUGEEN

Location	Proprietor	Type of Mill	Dates
Priceville	David Yeomans	saw	1858-1865-
Priceville	David Yeomans	grist	1858-1865-
Priceville	Purdy	flour	not known
Wilder's Lake	Hartley	saw	not known
Between Wilder's Lake and Durham	Aaron Vallett	saw	not known
Durham	John Edge	flour	1847-
Durham	John Edge	saw	1847-

Location	Proprietor	Type of Mill	Dates
Durham	John Edge	woollen	1847-
Durham	not known	saw	1853-
Durham	not known	flour and oatmeal	1859-
Durham	not known	woollen	-1865-
Varney	W. and N. Kerr	grist	-1865-
Allan Park, on Camp Creek	John Fensom	grist	-1865-
Allan Park, on Camp Creek	John Fensom	saw	-1865-
Lamlash	not known	saw	not known
2 miles north of Hanover	Wapler	saw	-1865-
Hanover	H. P. Adams	saw	1854-1865-
Hanover	H. P. Adams	grist	1855-1919
Hanover	not known	woollen	-1865-
Hanover, on Stewart's Creek	Thos. Crispin	furniture	1860-
Bruce, on Willow Creek	Richard McGregor	saw	1854-
Elderslie, one mile S.E. of Dumblane	not known	saw	-1946-
Port Elgin, on Mill Creek	Geo. Butchart	saw	1852-1854
	Benjamin Shantz, changed to	grist	1855-

2. On the Rocky Saugeen

The village of Markdale had its beginnings in 1849, when George Walker took up a lot on the Toronto-Sydenham Road and built his shanty near the four corners that became the centre of the settlement. It was not until 1855 that the newly settled village had a mill. In that year,

> "Matthew Irving built the Barrhead flour and saw mill. This four-storey building required all the men available for miles around for five days to raise the framework. It was a remarkable building for its day. It was a great boon to the community."*

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* Marsh. History of the County of Grey. p. 195.

The present Barhead Mill, a grist mill on the site of the former Barhead Mills, was first built in 1855.

A picnic party, in 1906, on the remains of Dunsmoor's dam. On this site, Alexander McNabb built the first dam on the Rocky Saugeen, in 1846, about four miles north of Durham. (From an old photograph, dated 1906.)

Other mills built near Markdale in the course of the next few years were Ford's flour mill and Sims' woollen mill.

Six miles below Markdale, on the Rocky Saugeen, is the village of Traverston, once known as Waverley. Here, about 1856, the partnership of Schofield & Collier planned an ambitious community, of which the main enterprise was to be their "mills". Their plan of the "town", published by Maclear & Co., Toronto, shows the locations of a saw mill, a flour mill, a cabinet and chair factory, and a general machine shop, in addition to various town lots represented as being sold to thirty-eight actual or prospective settlers, most of whom were holders of farm lots in Glenelg and other nearby townships. It seems probable that at first only the sawmill was built, since that is the only mill listed nine years later in the directory; by 1865 the sawmill had been sold to John Travers, whose name the village still bears. Modern maps of Traverston show both a sawmill and a grist mill, but their history between 1865 and the present time remains for the most part obscure.

At Hayward's Falls, Herbert Rowswell built a sawmill in 1857. At his death it passed in 1865 to Mary Rowswell who sold it in 1873 to Hayward. After that, the mill changed hands several times, the successive owners being Robert Jaques (1878), William Falkingham (1889), Minnis Brothers (1904), and W.L. Young.

In a biographical note sketching his career as a surveyor, Milton C. Schofield, Provincial Land Surveyor, wrote in 1908:

> "In 1848 I opened a country store on the Rocky Saugeen, in Bentinck, four miles north of the present town of Durham. In 1849 I was appointed postmaster. In 1850 I built a mill on the 'Rocky'."

The "mill" in question consisted of a sawmill and a flour mill at Glenrodin on the Rocky Saugeen, about a mile and a half east of the Garafraxa Road. Within a few years Schofield had sold these mills to Samuel B. Chaffey, who added an oatmeal mill and a carding and fulling mill to the enterprise; while

Schofield's interest appears to have been taken up with his partnership in the Waverley (Traverston) project.

Apart from the Indian sawmill at the Chippewa village near Southampton, the earliest mill on the Saugeen was a sawmill on the Rocky Saugeen, which the surveyor Rankin reported in his examination of mill sites on the Garafraxa Road. The report is dated March 7, 1846.

> "With reference to the reported good mill site on what is called the main branch of the Saugin (the Rocky Saugeen) there would have been a good site near the northern limit of the Reserve if it had been occupied before Mr. McNab built his Mill on the adjoining lot, but that being done destroys the chance of erecting one here without backing the water against him - his Site also is preferable to what this would even then have been."

Rankin's plan accompanying the foregoing report makes it clear that the "good mill site" is on the Rocky Saugeen...at the point where the Garafraxa Road crosses it, and that McNab's mill stood about a quarter of a mile upstream from that point, on the spot that in 1848 was the site of John Dunsmoor's saw- and flour mill. Dunsmoor's dam was washed out about 1906; and in 1911 the Durham Furniture Company rebuilt the dam and set up an electric power plant on the site of the old mills, which still (1952) supplies a large part of the Company's power requirements.

A short distance down stream from the Garafraxa Road, and on the Rocky Saugeen, Ferguson's Flour Mills were built in 1857, "a substantial stone building with 4 run of stone, and abundant water-power". It is said that Ferguson's right to the mill "privilege" was never wholly secure, and that he used great care not to raise the water above his dam to such a level as would back it against Dunsmoor's mill. In the directory of 1865, this mill is listed as the property of John McIlroy. It has for many years been disused.

In 1865 the directory states that Caton's sawmill was in operation at Aberdeen and that Francis Caton occupied Lot 41 in the 2nd Concession West of the Garafraxa Road. This lot had been originally patented in 1852 to Herman

Ferguson's grist mill, on the Rocky Saugeen River, one-quarter mile west of the Garafraxa Road. Built in 1857.

Grist and sawmill at Traverston (formerly Waverley). At or near this site, Messrs. Schofield & Collier first built a sawmill in 1856.

Schofield. In 1870 it was sold to one Kay, and by him in 1879 to James Crawford; and the mill came to be known as Crawford's Mills. Since 1934 the mill has not been in operation.

Some time prior to 1865, Robert Dalglish is said to have built a sawmill at the junction of the Rocky Saugeen with the main river, some four miles west of Durham. Dalglish called it the "Junction Mill," but among the country people of the neighbourhood it went by the name of "The Crotches". Lovell's Directory of Canada, 1871, lists Robert Dalglish as a mill-owner, but indicates that he was residing in Durham.

TABLE II

MILLS ON THE ROCKY SAUGEEN

Location	Proprietor	Type of Mill	Dates
Markdale	Matthew Irving	flour and saw	1855-
Markdale	J. W. Ford	flour	after 1855-
Markdale	Sims	woollen	not known
Traverston	Schofield and Collier	saw	1856-
Traverston	not known	grist	-1945-
Hayward's Falls	H. Rowswell	saw	1857-
	Hayward		1873-
	Jaques		1878-
	Falkingham		1889-
	Minnis Bros.		1904-
	Young		not known
Glenrodin	M. C. Schofield	saw flour	1850-
	Samuel Chaffey (added)	oatmeal woollen	-1865-
Rocky Saugeen	Alex. McNab	saw	1846-
	Dunsmoor	saw and flour	1848-1906
	Durham Furniture Co.	power plant	1911-
Rocky Saugeen	Ferguson	flour	1857-
	John McIlroy	flour	-1865-
Aberdeen	Francis Caton	saw	-1865-
	Kay		1870-
	James Crawford		1879-
	McIntyre		1909-
Mouth of the Rocky Saugeen	Robert Dalglish	saw	-1865-

3. On the South Branch of the Saugeen

When the first dam was built at Mount Forest, in 1850, it was supposed that the river at that place was a tributary of the Maitland, and the enterprise was called the Maitland Mills. To the original flour mill, a sawmill was added in 1856. The mills were located about half a mile down stream from the Garafraxa Road. A few years later, with John Martin as proprietor, the mills were known as Martins Mills; and in the Directory of the County of Wellington, 1869, three flouring mills were listed in Mount Forest: Martin and Sons, flour and oatmeal mills; Yeomans' mills; and Henderson's mills.

David Yeomans was the proprietor of a sawmill and grist mill close by the bridge where the Garafraxa Road crossed the South Branch; and, according to the Directory of Grey County, in 1865, William Henderson was the lessee of the grist mill. Between Yeomans' mill and that of the Martins there was, in 1865, a woollen mill, which "has one complete set of manufacturing machines, and also does custom carding, weaving, fulling, etc. It was built about 6 years ago (1859)". In the Directory of 1869, the woollen mill is listed as "Enterprise Woollen Mills, Tanner and Harris".

The Directory of Grey, 1865, described the mill-site at Ayton as excellent: "Water is abundant; the channel is narrow; the wooden dam is fastened to solid rock." Three mills were located here. The first sawmill was erected in 1861, followed by a grist mill in 1864 and a carding mill in 1865.

The purchase by David Winkler, in 1855, of 400 acres of land on the South Saugeen, six miles south of Hanover, marks the beginning of the village of Neustadt.

> "A little stream runs through the village, being a tributary of the south branch of the Saugeen, which at this point is called the Meux Creek. The Saugeen flows in a north-westerly direction about half a mile east of the village, where, at one time (about 1856), it looked as though the village would be situated. A grist mill, a woollen mill, an hotel, a flax mill and a general store were started there, and the site was called "Viel-Noethig" - ("much-needed"). However,

owing to the better water and power facilities on the little branch, Mr. David Winkler erected a saw mill, and (in 1857) a flour mill and grist mill there."*

According to the Directory of 1865, Mr. Winkler built his sawmill on Meux Creek in 1855, and his flouring mill, with two run of stones, supplied with water from the same dam, in 1857. The Directory also states that Winkler erected in 1864 a four-storey building on the South Branch (at "Viel-Noethig"), "intended for 4 run of stones", but does not indicate whether this mill was ever put into operation. In the same year (1864) the Neustadt Flax Mills, located at "Viel-Noethig" and using power from the South Branch, began operation, Messrs. Perine and Hendry being the proprietors. The flax at this mill was not manufactured into linen, but was merely scutched, and the product was sent to Doon in Waterloo County to be spun, woven, and bleached. At the present time (1952) nothing remains of the mills on the South Branch, though the grist mill on Meux Creek, partly burned, and re-built, is still in use. In the original stone foundation, the corner-stone, marked "D. W. 1857", is still to be seen. There is also a sawmill on the Meux Creek, not deriving power from the grist-mill dam, but from a dam a short distance farther up stream; the records of the village clerk indicate that this sawmill was built in 1870.

TABLE III

MILLS ON THE SOUTH BRANCH

Location	Proprietor	Type of Mill	Dates
Brice, Con IX, Lot 20, Proton Tp.	Thos. McDonald	saw (upright)	1857-
Cedarville	T. and W. Rogers	saw grist and oatmeal	-1865-
Mount Forest	David Yeomans	grist and saw	-1865-
Mount Forest	David Yeomans	woollen	1859-
Mount Forest	John Martin	flour and saw	1850- 1856-
5 miles N.W. of Mount Forest	John Dickson	saw and grist	-1865-

* Marsh. History of the County of Grey. p. 165.

Location	Proprietor	Type of Mill	Dates
Ayton	Thomas Robertson	saw grist woollen	1861- 1864- 1865-
Neustadt ("Viel-Neothig")	not known	grist woollen	1856- 1856-
	David Winkler	flour	1864-
Neustadt ("Viel-Neothig")	Perine and Hendry	flax scutching	1864-
Neustadt, Meux Creek	David Winkler	saw flour	1855- 1857-
	not known	saw	1870-

4. On the Beatty Saugeen

This is a relatively short branch of the Saugeen, and there are no large milling centres on it. Among the earliest mills there were two where the stream crosses the Garafraxa Road. John Orchard's sawmill (1858) and James Dodds' flour mill (1859) were located near the little village of Orchard. The mills of John Shields at Holstein were important factors in making that village a leading place of business in the Township of Egremont.

TABLE IV

MILLS ON THE BEATTY SAUGEEN

Location	Proprietor	Type of Mill	Dates
Dromore	not known	sawmill grist mill	not known
Yeovil	not known	"mills"	not known
Holstein	John Shields	sawmill flour mill	about 1855
Orchard	John Orchard	sawmill	1858-
Orchard	Jas. Dodds	flour mill	1859-
3 miles S. of Hanover, Con. III, Lot 11, Bentinck	McTavish	sawmill	-1865-
4 miles N. of Ayton	not known	saw	-1945-

5. On the North Branch of the Saugeen

The first sawmill in the Township of Holland was located at Holland Centre and was built at a date prior to 1853. On the same site has since been built a grist mill.

Williamsford, located on the Garafraxa Road at the point where it crosses the North Branch of the Saugeen, has since 1855 been an important milling centre. In that year a sawmill was built; the Directory of Grey, 1865, names A. E. Strathy as the proprietor.

> "From its water-power (being situated on the N. fork of the Saugeen) and its situation on the main road half way between Owen Sound and Durham, it may be expected to grow into a village of more or less importance. A new Gristmill is nearly completed, a little more than half a mile East, property of Walter and George Barnes. One and a quarter miles up the river is a Sawmill, lately erected, property of George Speers."*

In 1880 A. S. Elliot built the Monarch Mills at Williamsford. For several years there was also a woollen mill in operation at Williamsford; this was destroyed by fire in 1881.

The earliest mills at Chesley were built by A. S. Elliot and were known as the Elliot Mills. These consisted of a sawmill, built in 1858, and a grist mill, in 1859. In 1875, Messrs. J. H. Elliot and Alex. Ramage rebuilt the grist mill, which was then described as "the most complete of its kind".

TABLE V

MILLS ON THE NORTH BRANCH

Location	Proprietor	Type of Mill	Dates
2 miles N. E. of Holland Centre	not known	saw	-1945-
Holland Centre	Perry (or Greenaway)	saw (first in Holland Tp.)	not known
1¼ miles E. of Williamsford	George Speers	saw	1865-

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* Smith, W. W. Directory of the County of Grey, 1865, p.323.

Location	Proprietor	Type of Mill	Dates
½ mile E. of Williamsford	Walter & George Barnes	grist	1865-
Williamsford	not known	woollen	-1881
Williamsford	A.S. Elliot	flour	1880-
Williamsford	A.E. Strathy	saw	1855-
Lueck Mill	not known	saw	-1945-
Scone	Thos. Bearman Thos. Bearman	saw grist	1856- after 1856-
Chesley	A.S. Elliot A.S. Elliot	saw grist	1858- 1859-
Chesley	J.H. Elliot & Alex. Ramage	grist (rebuilt)	1875-
Chesley	Grosch & Rolston	felt mill	1886-
1½ miles W. of Chesley	Archibald McDonald	saw and oatmeal	1853-
Lockerby	not known	grist	1856-

6. On the Teeswater River

This important branch of the Saugeen River provides power for mills at no less than five points, namely Teeswater, Chepstow, Cargill, Pinkerton, and Paisley.

The original mill builder and operator at Teeswater was P.B. Brown, who built a sawmill in 1855 and a grist mill in 1856. In the Directory of the County of Bruce, 1867, Mr. Brown advertises: "Lumber of all kinds always on hand & cut to order. Gristing promptly done. Mill privilege and village lots for sale."

At Chepstow, John Phelan built the original dam and sawmill. Later, a grist mill was built on the same site. Three-quarters of a mile west of Chepstow, a sawmill was also built.

In 1856 the brothers McNeil built a dam and grist mill, at Cargill, which they later sold to George Elphick. In 1871, Elphick sold the mill privilege to Charles Mickle, Sr., who added a sawmill. The entire property was again sold in 1879, to Henry Cargill. Cargill later added a steam sawmill, a steam planing mill, and a steam grist mill.

Grist mill and dam, at Scone, built in 1856.

Sawmill and dam, one-and-a-half miles west of Chesley, on the North Branch of the Saugeen River. First mill on this site was built in 1853, by Archibald McDonald, and included an oatmeal mill.

Beginning about 1853, John Shennan built at Pinkerton a sawmill and a grist mill, which in 1854 he sold to David Pinkerton. Later a carding and fulling mill was added. The 1867 Directory also lists a shingle mill.

As early as 1851, John Valentine took possession of a mill site on the Teeswater River at Paisley, and in the following year built a sawmill. In 1855, Valentine built a grist mill. A survey by the land-surveyor Kerr, in 1856, shows Paisley to have in operation, at that time, three sawmills and one grist mill. By 1867 there was also a carding and woollen mill in operation at Paisley, but it is not stated whether it was on the Teeswater, or whether it made use of any water power. A mill privilege that was sold in 1859 by S.T. Rowe to David Hanna, and called the Fisher Mill, appears to have been located on the Main Saugeen River and not on the Teeswater. The History of Bruce County merely states that at this point milling was carried on.

TABLE VI

MILLS ON THE TEESWATER RIVER

Location	Proprietor	Type of Mill	Dates
Teeswater	P.B. Brown	saw	1855-
	P.B. Brown	grist	1856-
Formosa	John B.Kroetsch	saw	after 1850-
	John B.Kroetsch	grist	after 1860-
Formosa	not known	woollen	-1867-
Moscow (Cheviot)	Paul Ross	saw	1856-
	Paul Ross	grist	1868- (burned 1880)
Riversdale	George Cromar	steam sawmill	1857-
	George Cromar	steam grist mill	1857-
	rented to James Millar & Anthony Mason	saw and grist	1860- (burned)
	Anthony Mason	steam sawmill	1867-
	Anthony Mason	steam flour mill	1868-
Chepstow	John Phelan	saw	not known
¾ mile W. of Chepstow	not known	saw	-1946-

Location	Proprietor	Type of Mill	Dates
Cargill	McNeil Bros. sold to George Elphick	grist	1856-
	Chas. Mickle	grist and saw	1871-
	Henry Cargill	grist and saw	1879-
	Henry Cargill added	steam sawmill steam planing mill steam grist mill	not known
Pinkerton	John Shennan	saw	1853-
	John Shennan sold to	grist	1853-
	David Pinkerton	saw and grist	1854-
Pinkerton	Thos. Pinkerton	woollen	after 1858-
Paisley	John Valentine	saw	1852-
	John Valentine	grist	1855-
Paisley	David Hanna	not known	1859-
Paisley	Murdock & Orchard	woollen	-1867-

7. On Otter Creek

The principal centre of milling operations on the Otter Creek is at Mildmay. Here, in 1856, Samual Carr built a sawmill, operated by water power. In the basement of the same building, and in the same year, Lambert's carding mill was accommodated. In 1864 Wm. Murray changed the sawmill to a grist mill; not long afterward this mill was destroyed by fire, and in 1867 it was rebuilt. Later, the mill was again destroyed and the dam washed out. There is now no mill at this point.

About 1860, Messrs. Eidt & Noecker built the Mildmay Chopping Mill at the south end of the town, which later became the Mildmay Co-operative. This also, at the present time (1952), is no longer in use as a mill.

Berry's woollen mill was built on Otter Creek in 1866. McKelvie's woollen mill, built at the north end of the town, later became a furniture factory. Other "mills" at Mildmay include Bitschey's pottery works and Archie White's wagon factory.

At a point on the Otter Creek half-way between Mildmay and Walkerton, George Harrington in 1862 built a grist

mill which operated for about twenty-five years and then was burned. In the '70's another mill was built near the same spot by Messrs. Wm. Clendenning and W. Brown. This latter mill, upon its owners' financial failure, passed into the hands of the Merchants' Bank. In 1886 it was sold to Steinmiller, who operated it as the "Saugeen Valley Roller Mill." At the present time (1952) it is operated as an electric power plant, supplying power to the town of Walkerton.

TABLE VII

MILLS ON OTTER CREEK

Location	Proprietor	Type of Mill	Dates
Mildmay	Samuel Carr	saw	1856-
	Lambert	carding	1856-
	Wm. Murray changed to	grist mill	1864- (burned)
	Wm. Murray	grist (rebuilt)	1867-
Mildmay	Eidt & Noecker	chopping	1860-
Mildmay	Berry	woollen	1866-
Mildmay	McKelvie changed to	woollen furniture factory	not known "later"
Mildmay	Bitschey	pottery	not known
Mildmay	Archie White	wagon factory	1857-
Between Mildmay and Walkerton	Geo. Harrington	grist	1862 (burned 1887)
Between Mildmay and Walkerton	Wm. Clendenning sold to	flour	after 1870-
	Steinmiller became	roller flour electric power plant	1886

TABLE VIII

MILLS NOT LOCATED ON WATER POWER

Location	Proprietor	Type of Mill	Dates
4 miles E. of Priceville	not known	saw	-1945-
Hopeville	not known	saw	"early"
Fulton's Station	not known	saw	-1937-
Clifford	Veitch Bros.	steam sawmill (later Diesel-powered)	-1869-

Location	Proprietor	Type of Mill	Dates
Clifford	J. Boomer	grist	-1869-
Clifford	A. Kerr	planing	-1869-
Clifford	F.F. Dobson	shingle	-1869-
Clare, in Egremont Tp.	Thorpe	saw	not known
Lauriston, in Glenelg Tp.	not known	saw	-1945-
3 miles S.W. of Dornoch	not known	saw	-1945-
West Bentinck	James Wilson	saw	1857-
Mulock (or Corinth)	Douglass	saw	not known
Berkeley	not known	saw	-1945-
Eden Grove	Munn & Webster	saw and shingle	1873-
Elmwood	Johnson Smith	saw	1875-
Elmwood	John Dirstein	saw	1875-
Elmwood	not known	grist	1864-
Hanover	H.P. Adams & Jacob Messinger	woollen	1870-
Kinlough	Simon Corrigan	saw	1857-
Kinloss	J. Eli Stauffer	saw	1854-
7 miles W. of Paisley	not known	grist	-1946-
Glammis	John Fraser sold to McIntyre, then to Pickard	saw	"early" -

CHAPTER 4

AGRICULTURE

The beginnings of settlement in the Saugeen found the uplands covered with a hardwood forest and the low-lying lands covered with swamps where cedars, tamarack and ash were the characteristic growth. Along the river flats there were extensive areas of native grasses; and these were regarded as the basis of the earliest agriculture, a crop ready to hand, provision for the ox, the horse, and the cow, for which neither clearing nor seeding was required. The following passages, taken from the earliest survey reports of three townships in the Saugeen Watershed, will indicate the value that was set on these natural meadows.

Sullivan Township

> "It affords every inducement to Settlers, presenting generally the agreeable features of an undulating surface, good soil (principally clay), and an excellent quality of timber, to which advantages may be added that of its containing a great number of beautiful meadows on which usually prevails what is always a desideratum in going upon new lands, excellent grass." *

Osprey Township

> "There are several natural or Beaver Meadows in this Township, some of which afford a very good description of grass and will be found very useful by those who will settle near them being so found by the squatters already there." †

Minto Township

> "Most of the little Streams, whether running into the Saugin or into the Maitland, are bordered in places with meadows, which will naturally prove an advantage to the first Settlers, as affording fodder for their cattle before tame meadows can be made." **

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* Dennis, J.S. Survey Report, Sullivan Township, 1843. Ontario Department of Lands and Forests, Surveyors' Letters, Vol. 2, p. 487.

† Rankin, Charles. Survey Report, Osprey Township, 1850. Ontario Department of Lands and Forests, Field Notes, Vol. 18, p. 430.

** Rankin, Charles. Survey Report, Minto Township, 1852. Ontario Department of Lands and Forests, Survey Notebook No. 1484.

The first census report of agricultural production in the Saugeen country, that of 1851, indicates that wheat and oats were the chief grains, potatoes and turnips the chief non-cereal crops; some two thousand tons of hay, mostly from natural meadows, was cut; and considerable quantities of butter, cheese and wool were produced. Thirty-five thousand pounds of maple sugar were harvested.

In spite of the success attributed to the Petuns*, the white settlers in the Saugeen have never made much of either tobacco or Indian corn; both these crops appear to have been tried in the earliest pioneer days and subsequently discarded. The census of 1851 reports, over the entire Saugeen Watershed, no more than 120 pounds of tobacco; in later reports, none was shown. Indian corn, in 1851, amounted to 1.1 per cent of the reported grain yield, and thereafter it never amounted to more than 0.3 per cent of the total grain, this maximum having been shown in 1891. In the latest census in which yields of grain are reported, that of 1921, Indian corn amounted to less than one-one hundredth of one per cent of the total grain in the watershed.

In 1861, when fall and spring wheat were first reported separately, the spring wheat greatly exceeded the fall wheat. During the decade 1871-1881, the fall wheat took the lead and has held it ever since. These comparisons are shown in the following table:

Year of Census	Spring Wheat (Bushels)	Fall Wheat (Bushels)	Total
(1851	....	........)	65,190
1861	807,591	27,989	835,580
1871	702,354	99,282	801,636
1881	451,798	1,288,606	1,740,404
1891	209,873	663,724	873,597
1901	161,366	734,069	895,435
1911	52,509	778,501	831,010
1921	45,291	527,739	573,030

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* Bruce, G.W. The Petuns. O.H.S. P. & R., VIII: 35, 1908.

The yields of oats, barley and peas-and-beans (which, from 1871 on, are reported together) are shown here for comparison with the yields of wheat.

Year of Census	Oats (Bushels)	Barley (Bushels)	Peas & Beans (Bushels)
1851	54,970	3,443	9,154 *
1861	393,329	32,653	129,754 *
1871	1,186,448	244,397	477,321
1881	1,923,532	282,027	865,755
1891	3,097,325	282,322	1,112,173
1901	532,220	657,248	1,077,918
1911	5,727,577	796,292	448,849
1921	5,859,989	542,083	130,505

* Peas only

The yields of potatoes, roots and hay are shown in the following table.

Year of Census	Potatoes (Bushels)	Turnips and Other Roots (Bushels)	Hay (Tons)
1851	96,015	55,196	2,322
1861	570,110	1,307,959	19,217
1871	747,746	1,391,256	71,909
1881	772,552	2,399,152	103,014
1891	901,382	3,063,271	183,258
1901	759,368	4,324,253	136,038
1911	690,352	2,722,468	212,766
1921	621,098	2,258,573	185,027

The census reports show the numbers of farm animals by townships (from which the corresponding numbers for the watershed may be calculated) only in the years 1851, 1861, 1891, 1931 and 1941; and the data for 1901 provide an approximate basis for a similar calculation. The census enumerations for 1871, 1881 and 1911 were based on the electoral district, and those of 1921 on the county, as a unit of area; and it is not possible even to estimate from such data the proportionate numbers in the watershed. The following tables show, as nearly as they can be calculated, the numbers of farm animals in the Saugeen Watershed and the production of butter, cheese and wool.

Year of Census	Cattle	Horses	Sheep	Swine
1851	7,542	320	3,132	3,571
1861	38,973	4,604	18,751	25,436
1871				
1881				
1891	106,993	33,884	76,377	44,429
1901	128,683	29,736	82,049	67,949
1911				
1921				
1931	128,394	27,812	73,413	77,201
1941	142,654	26,037	52,115	97,673

Year of Census	Butter (Lbs.)	Cheese (Lbs.)	Wool (Lbs.)
1851	85,660	3,970	7,829
1861	623,624	29,035	38,093
1871			
1881			
1891	2,674,006	61,932	344,984
1901	3,966,069	1,631,206	401,540
1911			
1921			
1931	2,251,875	1,150*	566,667

* Amount produced on farms only

The data appear to warrant the following comments.

Spring wheat reached its peak in 1861, and has since been continuously declining.

Fall wheat reached its peak in 1881, and has since held fairly steadily to approximately half the amount of that peak. In 1921 it exceeded spring wheat about 13 to 1.

Oats increasing continuously up to 1921, when census report of quantities produced ceased.

Barley reached its peak in 1911 and fell off 32 per cent by 1921, when last reported.

Peas and beans reached a peak in 1891, and after 1901 declined rapidly.

Potatoes reached a peak in 1891, and by 1921 had declined 31 per cent.

Turnips and other roots reached a peak in 1901, and by 1921 had declined 48 per cent.

Hay reached a peak in 1911, then fell off 13 per cent.

Cattle, so far as data are reported, show a continuous increase from 1851 to 1941. The census does not distinguish between dairy cattle and beef cattle.

Horses reached a peak number in 1891 and have since then been gradually declining, largely, no doubt, because of their replacement by mechanical equipment.

Sheep reached a peak in 1901, the number reported in 1941 being 35 per cent of that peak.

Swine - the numbers show a continuous increase up to 1941.

Butter - the figures given indicate a peak in 1901; but the lack of reliable data in 1911 and 1921, together with the trend toward creamery production (not included in the census returns) makes the record too uncertain for satisfactory analysis.

Wool - the data indicate a continuous increase up to 1931, which is not, in the period from 1901 to 1931, parallel with the data on the numbers of sheep. The lack of any data in the intervening decades makes reliable analysis impossible.

In general, the record of the census shows a region engaged in mixed farming, in which the food-producing animals have been continuously increasing; while those crops that supply feed for the animals have tended to predominate over the crops that yield food for immediate human consumption. This trend in the crops has become more pronounced since 1891, when wheat, peas and beans, and potatoes had reached and passed their production peaks.

LAND

CHAPTER 1

GEOLOGY

Geology is the science which studies the material which forms the earth's crust. This chapter describes briefly the "bedrock" geology of the watershed. This information was obtained from maps published by the Dominion Department of Mines and Resources.

Bedrock geology is important in the consideration of the rivers, soil, and agriculture of the watershed. The way in which the bedrock influences these factors is described.

1. Historical

The bedrock of the Saugeen Watershed is composed of sedimentary rocks, that is, sediments were laid down in water and formed into rocks by the processes of cementation and compression. During past geologic time the North American continent was invaded many times by seas. Materials eroded from the adjacent land areas by the action of streams were deposited in these seas to form the rocks of today. The materials carried in suspension were usually fine gravel, sand and mud which eventually became conglomerate sandstone and shale. In addition, marine animals extracted calcium carbonate out of solution to form their shells, which accumulated in great quantities to form limestone, a type of rock which is very abundant in Southern Ontario. As the sediments were deposited in water they formed more or less regular layers or strata. Sedimentary rocks are therefore said to be stratified.

Rocks are classified not only as to their type, but as to the period in the earth's history when they were laid down. Time is divided into eras, which encompass millions of years, and eras are then further subdivided into periods. The rocks of each period are called a system and the systems are subdivided into series, groups and formations.

Limestone outcrop along the Rocky Saugeen, near Aberdeen. Limestone is a major constituent of the soils of the watershed.

The Main Branch of the Saugeen south of Priceville. The direction of flow of this stream is controlled by the dip of the bedrock.

The waterspouts on the Rocky Saugeen below Traverston. Water flows underground in solution channels in the bedrock.

The bedrock formations of the Saugeen Watershed belong to the Paleozoic era, a term meaning "old life", so named because of the types of fossils found in these rocks. The rocks of this part of Ontario were laid down in the Silurian Period. The most characteristic topographic feature of the Silurian system in Ontario is the Niagara escarpment which separates the Western Ontario Uplands from the St. Lawrence Lowlands to the east. The escarpment is an erosional feature and, since it is capped by a resistant formation, it is able to retreat while keeping an almost perpendicular face. The scenic Beaver Valley just to the east of the watershed is the result of river erosion which has cut a deep notch into the Silurian rocks. This fact has made possible the development of hydro-electric power at Eugenia Falls.

From the escarpment face, the Silurian rocks dip gently westward, giving progressively lower elevations. This change in elevation is accentuated by a broad up-arching of the bedrock caused by large-scaled earth movements. This structure is called the Ontario Upland. Thus the highest point is not on the brow of the escarpment, as might be expected, but around Dundalk, which is near the top of the arch. This progressive lowering of altitude westward is the main factor in determining the course of the Saugeen River. The Saugeen and its tributaries are flowing down the dip-slope of the escarpment. The Rocky Saugeen has cut through the overlying deposits and is incising its channel into bedrock for much of its length. The main branch, however, only encounters bedrock at one place, Glenelg Centre.

2. <u>Characteristics of the Rocks</u>

Three different formations comprise the Saugeen bedrock - the Lockport, Guelph and Salina formations. All three are composed largely of dolomitic limestone, that is, limestone which contains a high proportion of magnesium carbonate as well as calcium carbonate, the chief constituent of ordinary

limestone. The Lockport Dolomite is light gray in colour and is quite hard and massive. When exposed to weathering it tends to split off in large blocks. The Lockport formation forms the resistant cap of the Niagara escarpment. The Guelph formation differs slightly in colour and chemical composition. Both have been quarried extensively for building stone. The Salina formation is composed largely of brown-coloured dense dolomite. It is not as hard as the first two and weathers more rapidly. The formation also contains some shale and, in some parts of the Province, salt and gypsum.

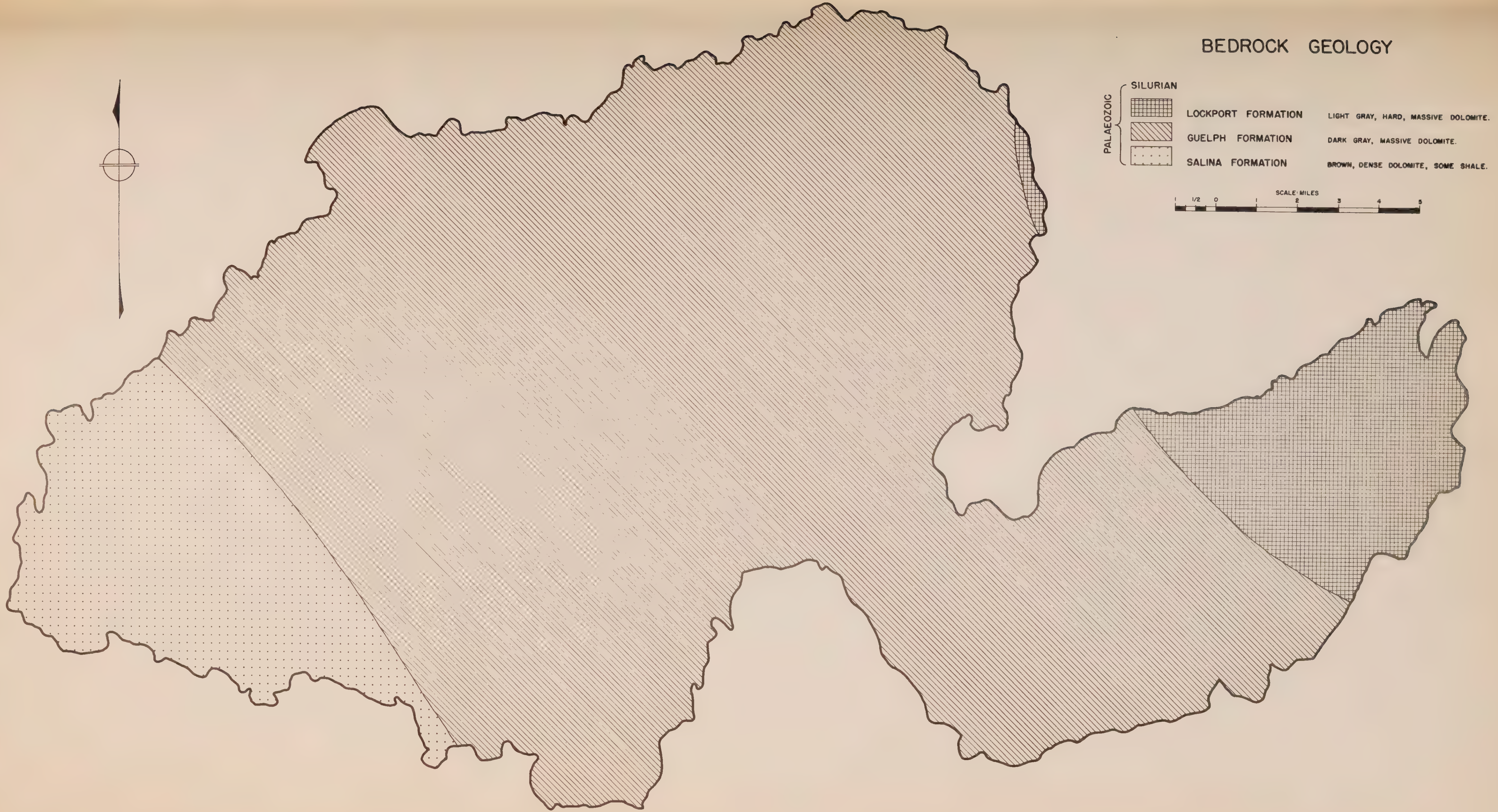
The presence of limestone bedrock has profoundly influenced the soils of the Saugeen Watershed. The bedrock was eroded, ground up and re-deposited by the action of continental glaciers (which will be discussed in the next chapter). Therefore, the soil materials of the area have a high lime content. This factor has in turn influenced the rate of development of the soils. Because of the high lime content, leaching by water has been inhibited, giving rather shallow profiles throughout the area. The high lime content of the soils together with their loamy and gravelly nature make the streams run clear, even after heavy summer rainfall.

In some places, the limestone bedrock has tended to limit agriculture. Sometimes, the glaciers quarried out the limestone in large pieces and later re-deposited them as boulders. Often the boulders are numerous enough to preclude cultivation entirely.

Limestone bedrock is very porous and allows water to seep through it readily. Therefore, areas where the bedrock is close to the surface tend to be somewhat droughty. Sometimes underground channels are formed by solution and a system of underground drainage is established. Such underground drainage forms the spectacular waterspouts west of Traverston.

3. Recent Geological Deposits

The recent geologic deposits overlie the bedrock as an unconsolidated mantle. These deposits are the result of continental glaciers which moved over the area from the north. These deposits and the landforms associated with them will be described fully in the next chapter.


BEDROCK GEOLOGY
PALAEOZOIC
SILURIAN
LOCKPORT FORMATION
LIGHT GRAY, HARD, MASSIVE DOLOMITE.
GUELPH FORMATION
DARK GRAY, MASSIVE DOLOMITE.
SALINA FORMATION
BROWN, DENSE DOLOMITE, SOME SHALE.
SCALE: MILES
1/2 0 1 2 3 4 5

CHAPTER 2

PHYSIOGRAPHY

1. Introduction

This chapter deals with the surface relief as it appears today, that is, the landforms and the materials from which they have been formed. Most of the landforms and materials are the result of glaciation. While the different types of landforms are usually referred to in terms in use in glacial geology, throughout this report local names will be used as far as possible.

2. Glaciation

During the recent geologic past, in the age called the Pleistocene, Canada was covered by a great continental ice-sheet. The masses of ice forming the ice-sheet reached thousands of feet in thickness. While it is believed that the ice advanced and covered Ontario three times, it was the last glaciation which moulded the surface of the land into the forms which we see today.

The landforms arising from glaciation fall into two main groups. The first group was formed during a period of ice advance. During this period the ice sheet was being built up and the ice front was moving across the country. The second group was formed during a period of stagnation, when the ice front was retreating and the ice sheet itself was becoming thinner due to melting.

In the "advance" phase, rock material was broken up, pulverized, moved and redeposited. This redeposited material is known collectively as "till" and the resulting landform is called a "till plain". Till varies in texture from "light" to "heavy" depending on the amount of clay it contains. All till contains a great number of stones, mostly angular in shape.

Sometimes the glacier moulded the till into long oval-shaped hills which are often called whalebacks. The geologic name given to a hill of this sort is a drumlin, a Celtic word meaning "little hill". Drumlins characteristically have one steep end, called the "stoss" end, and a long tapering tail pointing in the direction of ice movement. The soils of the drumlins are loamy and well drained, but the areas in between them are usually swampy. They vary greatly in size and height, ranging from quite large hills to very shallow ridges called flutings.

Whenever the glacier halted for a sufficient length of time, a ridge of till was built up in front of it. This is called an end moraine. Moraines are characterized by a great many knobs and depressions and sharp, abrupt slopes. They always contain much rough land and are sometimes excessively stony.

During periods of stagnation, deposits were formed underneath the melting ice front. These are the "ice-contact" formations and the materials in the formations are sorted and roughly stratified by the action of water. Delta-like fans were built against the ice face by meltwaters and when the ice finally disappeared these materials slumped down to form conical hills called kames. A succession of these type of landforms is called a kame moraine. Kames are a valuable source of gravel. Often rivers flowed within the ice sheet itself. These rivers deposited gravel in their beds and when the ice melted, the gravel slumped down to form a long sinuous ridge, which in some cases may be traced for several miles. These are called eskers, and again they are extensively used for gravel.

Meltwaters flowing away from the ice sheet carved deep valleys, called spillways, through the moraines and the till plains. These valleys are characteristically wide and flat-floored, and have extensive gravel deposits along the sides.

A drumlin. This landscape is characteristic of the Bentinck Whaleback Hills. Glenelg Township.

The Glenelg Gravelly Hills. Note the sharp slopes and irregular topography.

The Holland Ridge, south of Berkley.

The bottoms are usually swampy. Sometimes the present-day drainage makes use of these channels, although others are dry.

The final type of glacial landform is material which was left when the ice simply disintegrated. This is known as ablation moraine, and forms a superficial covering in many parts of the watershed. It is very coarse, stony material from which most of the fine particles have been removed, leaving only the coarser silts, sands and gravels. They have not been sorted by water and exhibit no stratification.

3. Landscape Types

On the basis of landforms the Saugeen Watershed can be divided up into a number of landscape types. These types are not always continuous, and each may contain inclusions of other types. However, their classification is fundamental to the recognition of the soil types found on the watershed.

(a) The Holland Ridge

The Holland Ridge forms the northern boundary of the watershed and extends through Osprey and Artemesia Townships to form the eastern boundary. It is a typical end moraine described in the previous section. The topography is rough and broken with many steep slopes and swampy depressions. The materials grade from medium-textured till in the western section to light stony till in the east. The Holland Ridge also contains large limestone boulders which have been plucked off the face of the Niagara escarpment by glacial action.

(b) The Hanover Sandy Plain

The Hanover Sandy Plain occupies part of the western section of the watershed around the town of Hanover. The plain has an undulating surface and rises in a series of steps or terraces on each side of the Saugeen River. The terraces were deposited by a post-glacial river which carved out the present Saugeen Valley. The soils in this area are sandy,

although the upper terraces contain a large proportion of gravel. All the materials exhibit stratification.

(c) The Bentinck Whaleback Hills

This type occurs in most of the northern and eastern part of Bentinck Township and part of Glenelg Township. The whaleback hills are the drumlins which were described above. They have long, smooth, slopes and are easily recognizable in that the steep, or "stoss" ends, are usually forested. Swamps are common on the inter-drumlin areas. The region is complicated by the presence of ice-contact features among the drumlins. There are a number of small eskers following the low areas and the occasional kame is also found. In addition, the hills have received a superficial covering of ablation moraine which gives the surface a stony appearance. The material which forms the hills is loamy in texture, giving rise to good agricultural soils.

(d) The Durham Rolling Plain

The Durham Rolling Plain is found to the west of the town of Durham and again in the Edge Hill area. It is a till plain and is formed of similar material to the Whaleback Hills, and the soils are therefore loamy. The plain is not flat, but rolling in nature, although drumlinization is not noticeable.

(e) The Glenelg Gravelly Hills

The Glenelg Gravelly Hills occupy nearly all of the southern and eastern part of Glenelg Township. This is a rugged hilly type, with very little level land, and many of the slopes are extremely steep. The gravelly hills are for the most part ice-contact deposits - kames, kame moraines and gravel terraces. The deposits are roughly stratified, although some of the materials are so coarse that the stratification and sorting is not always evident. Because of the coarse, open texture of the materials, the soils are extremely thin and porous, so that summer drought is a constant hazard. The steep slopes and gravelly nature of the soils limit the use of modern

The Dundalk Silty Plain in Proton Township.

The Durham Rolling Plain. Glenelg Township.

The Bell Lake Spillway. This is characteristic of the Saugeen Swampy Flats. The poorly drained section in the bottom of the spillway usually remains in cedar swamp.

agricultural machinery. For these reasons a large part of the Glenelg Gravelly Hills are either forested or are left for pasture.

A group of hills similar in nature to the Glenelg Gravelly Hills is found near Alan Park. Part of these hills can be seen along No. 4 Highway just east of Alan Park. Here the material is very stony. South of Alan Park the hills are broken by a large glacial spillway, but they reappear on the south side of the spillway. Here the materials forming the hills are partly stratified sand, in contrast to the gravels to the north. Like the Glenelg Gravelly Hills, forest and pasture are the predominant uses of the area.

(f) The Markdale Rolling Plain

This type is clearly defined as a region. It lies south and east of the village of Markdale, between the Glenelg Gravelly Hills and the Holland Ridge. The area is a rolling plain, similar to that around Durham, and is a typical till plain. However, the materials forming the plain are much coarser than those of the Durham Plain, giving rise to quite stony soils. The headwaters of the Rocky Saugeen flow through this region.

(g) The Dundalk Silty Plain

This landform type occupies nearly all the eastern part of the watershed, in Osprey, Proton and Melancthon Townships. It is a very distinctive region and is part of an extensive till plain which covers much of the central Ontario Uplands. The northern margins of the region are marked by a few low drumlins, which become low ridges toward the south. Throughout the Dundalk Plain, drainage conditions are poor, especially between the ridges. The low ridges are important agriculturally, since they dry up earlier in the spring. No. 10 Highway follows a zig-zag course to take advantage of the drier ridges. The road crosses the swampy areas at the narrowest points, thus avoiding long stretches of expensive fill.

The Dundalk Till Plain is very different from the other two till plains of the Saugeen. Besides being poorly drained, it has received a superficial deposit of silt on the surface. Whether the silt was deposited through the action of water or by the action of wind in the post-glacial period cannot be exactly determined. However, this is not of great importance. The silt is variable in depth from a few inches to over two feet. It is usually deeper in the hollows than on the ridges.

The Dundalk Plain also has some scattered ice-contact deposits. There are a number of kames near Proton Station and there is a large kame to be seen on No. 10 Highway north of the Proton side-road. It has been partly demolished to provide gravel. There is a large esker in the Osprey Swamp, which forms the eastern boundary of the watershed. There are also some small eskers and kames scattered through the Proton Swamp.

The main branch of the Saugeen River rises in the Dundalk Plain. In this region it follows a meandering course over the plain in a very shallow valley. Because of this, it is susceptible to flooding during the spring. Ice tends to pile up in the river and the shallow valley is unable to contain the water from melting snow.

(h) The Saugeen Swampy Flats

The Flats do not form a continuous region, but are found scattered throughout the whole watershed. They are the bottoms of the valleys cut by the rivers carrying away the meltwaters from the retreating glacier. Sometimes they are occupied by streams, but often no permanent streams are found. Sometimes the valleys are not connected and seem to end abruptly. This has been due to blocking by later deposits.

The Saugeen Flats are almost always swampy, although the materials are largely gravels, sands and silts. Often they contain depressions which have formed small lakes. These lakes are kept in existence by the high water table and

by springs and run-off from the valley sides. Bell Lake, Farden Lake and Wilder Lake are examples of this type. The lakes are gradually becoming filled up with acquatic vegetation. Wilder Lake was once an important source of marl, a deposit of almost pure calcium carbonate. Water flowing over the lime-rich soil materials absorbs lime in solution. It is then precipitated out in the quiet waters of the lake.

The Saugeen Flats are of little use agriculturally, although some are dry enough for pasture. Usually the valley bottoms support only coniferous trees. In some places, notably at Alan Park, the flats are a valuable source of gravel.

4. The Drainage Pattern

The control exercised by the general westward slope of the Ontario Uplands has already been mentioned. However, the over-all drainage picture is one of immaturity in the smaller tributaries. These streams either meander sluggishly through the old meltwater channels, sometimes losing themselves in swamps or small lakes, or they follow a tortuous course through the hills.

Topography exercises a large measure of control on the upper reaches of the Rocky Saugeen. The curve of the Holland Ridge causes the course of the river to turn almost completely around from its original direction.

5. Conclusion

A variety of landforms and material moulded and deposited by glacial action covers the rocks of the watershed. These materials and forms constitute the dominating factor of soil and land use. They are also responsible for much of the pattern of surface drainage. Reference to the map of landscape types which accompanies this chapter will help in understanding the physical features of the watershed.


LANDSCAPE TYPES
HOLLAND RIDGE
HANOVER SANDY PLAIN
BENTINCK WHALE BACK HILLS
DURHAM ROLLING PLAIN
GLENELG GRAVELLY HILLS
MARKDALE ROLLING PLAIN
DUNDALK SILTY PLAIN
SWAMPY SAUGEEN FLATS
SCALE-MILES
1 1/2 0 1 2 3 4 5

CHAPTER 3

GENERAL CONSIDERATIONS

1. The Purpose of the Survey

A soil conservation survey is made to compile an inventory of soil resources and present use and to appraise the capabilities of the land. From this inventory and appraisal there can be derived a pattern of land use which, if carried out, would adjust the use of the land more nearly to its capabilities. In this report a map of Recommended Land Use has been prepared. This is based on the observations made in the field survey.

2. Methods of Survey

The soil map of Grey County, prepared by the Ontario Soil Survey, formed the basis of the soil conservation survey. In addition, the soil types as described on the map were correlated with the landforms by field observation. All soil and land use mapping was done on aerial photographs on a scale of one inch to one thousand feet. Field work was done from vehicles traversing all roads and accessible lanes and on foot where necessary.

The mapping of the watershed was done on a reconnaissance scale. To get a detailed picture of the soil conditions, a sample strip was chosen which crossed a representative sample of the soil types and landforms which are found on the watershed. The area chosen was a continuous strip beginning one block west of the Bruce-Grey town line on Concessions V and VI and extending across the watershed to Highway No. 10. Here the detail strip turned south-east and continued along the west side of Highway No. 10 to Dundalk. A small section on each side of Flesherton lay outside the watershed, but was included in the detail survey in order to get continuity in the mapping.

In addition to identifying the soil types on the detail strip, the soil conditions were observed and

recorded. These included the degree of slope, the amount of soil erosion that has taken place, the internal drainage of the soil and the intensity of stoniness and boulderiness. These conditions were mapped on aerial photographs, the smallest unit area being four acres. In addition, the present land use, whether cultivated, pasture, forest, or idle land was mapped field by field. Supplementary sources of water, in addition to the farm wells, were also included in the survey. The knowledge derived from the detail study was used to estimate land use capability and to set up a reconnaissance classification of the whole watershed.

3. Study of Sizes and Types of Farms

Remedial measures to conserve soil and water on the whole watershed would be much wider in scope than those offered by individual farm plans. There is wide variation in type and intensity of land use and much land is marginal and submarginal economically. It was therefore necessary to map out regions of the watershed according to the use of wide areas. This was done in two ways. First, from township rolls the sizes of individual holdings were obtained and plotted on a map. Second, each farm was visited and by superficial examination was classified according to the apparent efficiency and capital outlay. This in no way can be applied to any one farm, for the capital value and efficiency of a farm are matters known only to the farmer himself, but reduced to a map which shows the general characteristics of farms in degrees throughout the watershed, this information throws much light on the conditions of the watershed as a whole.

4. Definition of Soil

The soil is a living body. It is made up of unconsolidated mineral material, living micro-organisms and the remains of dead plants and animals. It is formed by the interaction of living things, on and within the soil, and air and water with the mineral material. The soil provides the

medium for the germination and growth of the plants that man uses. The quality of a soil is measured in terms of its capability to support the crops that man wishes to grow on it.

The strongest influences in the formation of soil are climate and vegetation. The soils of the watershed, like most of the soils of Southern Ontario, have been formed under a moist, cool, temperate climate and a covering of hardwood or mixed hardwood forest. The soil-building process under these conditions is called "podsolization" and the group of soils thus formed is called "the Gray-Brown Forest (or podsolic) soils".

The process of podsolization in the building of a soil is as follows. Organic matter, leaves, dead wood and grass or any other vegetative product on the surface decays by microbial action. The activity of animals such as earthworms and rodents mixes the decayed organic matter (humus) with the mineral material. Decomposition of organic matter produces acids. These acids are leached downward through the soil by the excess rainfall of spring and fall. From the soil below the point where humus and mineral matter is mixed, there are removed certain components, the lime and magnesia, salts of iron and the very finest particles, the colloids. This makes in the soil a zone of leaching.

Below the zone of leaching the downward action of the soil moisture is slowed up and some of the components are redeposited. The iron compounds accumulate and give to the soil a characteristic brown colour. The colloids accumulate and make the soil stickier. The lime is carried through the farthest. At a greater depth, anywhere from a foot to four feet, depending on the nature of the ground and the climate, no weathering action takes place and the parent mineral material remains unaffected.

A cross-section of a soil will reveal these differences at different levels. Such a cross-section is known as a soil profile. The levels at which the phenomena

described above appear are called "soil horizons". Combinations of the various factors affecting soil development will produce for each "soil type" a different profile with its own particular group of horizons.

The following detailed description sets forth the profile of an idealized soil to illustrate the terms used in describing soil profiles.

Horizon	Name	Description	Common Name
A_0	Humus	Partly decomposed organic debris found only on undisturbed soils in forests.	The A horizons together constitute "topsoil"
A_1	Melanized horizon	Surface horizon of mineral soil with greatest amount of decomposed organic matter, dark in colour, loose and friable; may be lacking or, in cultivated soils, may have been incorporated with lower horizons.	Topsoil
A_2	Horizon of leaching	Light-coloured, grayish powdery material, has little or no organic content. Under cultivation the A_1 and A_2 may be mixed together. The resulting horizon may be called "A_c (cultivated) horizon".	Topsoil
B_2	Horizon of accumulation	Dark, brownish or red-brown, nut-structured or cloddy; due to accumulation of colloids, this horizon is stickier than either the topsoil or the parent material.	Subsoil
B_3		Transitional zone between the B_2 and parent material. In soils with inadequate internal drainage this horizon shows mottling of brown and gray.	Subsoil
C	Parent material	Unweathered mineral material, sand, silt, clay or loam depending on the mode of deposition. (If lime or magnesium carbonate is present, they cannot be found free, by the acid test, in the upper horizons.)	

Variations from this idealized profile are found. The two main factors which affect profile development are parent material and soil climate which depends on drainage. Examples of the extreme differences are here described.

Soils developed on coarse, open material such as sand or gravel have usually much deeper profiles because the water is able to move more freely downward. The process of podsolization leaches lime out of the soil; if there is a high concentration of lime in the parent material this process is opposed and the profile is more shallow. In some soils, the concentration of lime is so high that it can be found in any one of the horizons. Such soils are usually "young" soils, that is, the soil-forming processes have not been in operation long enough to effect complete profile development. This type of soil is known as a "Brown Forest soil" and is characteristically shallow and has no leached horizon. Excessively drained materials allow greater aeration and the resulting oxidation reduces the amount of humus; conversely, inadequately drained soils tend to have a higher proportion of humus in the surface horizon.

The soil-building processes are going on all the time. Erosion occurs on the surface; as the soil becomes exposed weathering penetrates deeper and the profile is maintained. When the soil-building processes have had optimum conditions and have gone on for a long time, that is, thousands of years, the soil is considered to be mature. Soil building and erosion can be in an equilibrium. When erosion occurs at a faster rate than soil is built, as in soils exposed by cultivation, "accelerated erosion" is said to be taking place. This is the erosion, "wash", "gullying" and "wind erosion", which is the concern of the conservationists.

When a soil is inadequately drained or there is a fluctuating water table near the surface, the soil-building process, which is due mainly to the downward movement and the aeration of the soil, is restricted. Profiles of soil are then shallower. The characteristic brown colour of the subsoil is lacking because the iron compounds are chemically reduced. Oxidized iron compounds are characteristically brown and reduced compounds are gray. When the water table fluctuates the subsoil is mottled gray and brown. If the water table is permanently high the subsoil is gray. In either of these cases a subsoil is formed that is very sticky due to

the concentration of colloidal material. This kind of subsoil is called "glei".

The soils of the watershed are not as old as those of other parts of Ontario. The leached horizon is not always visible and the depth of the whole profile is usually less than two feet. The predominance of limestone restricts the soil-building process in some areas and Brown Forest soils develop.

5. Soil Classification

The soils of Ontario can be grouped into associations, series, types and phases. Soils that are formed on the same parent material in the same landform belong to the same "association". Within this group are found "series" that are said to be "associated". A "soil series" has the same profile development wherever it is found. The Ontario Soil Survey assigns names to soil series when they map the counties. When a series is found that has not already been identified, a name is assigned to it, usually taken from the name of the locality in which the series was first identified. A soil series is recognized on the basis of the profile development according to the internal drainage of the soils in each association. Thus on the same parent material, a number of series may develop, ranging from a deep, excessively drained profile to a shallow, poorly drained profile.

6. Soil Conditions

The chief problem in soil conservation is to control the erosion of the soil and the consequent loss of water-holding capacity of the soil, and the accelerated surface run-off of water. It is necessary, then, in a conservation survey to determine what land is sloping and susceptible to erosion and what land has already experienced soil erosion. The following slope classes (adapted and modified from the U. S. Soil Conservation Service conservation surveys) are used in this report.

Gully erosion on a smooth slope. This gully is just beginning and can easily be remedied by constructing a grassed waterway.

Rill and sheet erosion, showing the deposition of soil wash at the foot of the slope.

Erosion scars on a steep slope. This land is too steep for cultivation, but serious erosion has taken place with the removal of tree cover, and overgrazing.

Smooth, Regular Slopes		Hummocky, Irregular Slopes	
Per Cent	Mapping Symbol	Per Cent	Mapping Symbol
0 - 2	A	0 - 7	M
2 - 5	B	7 - 15	N
5 - 10	C	15 - 25	P
10 - 15	D	Over 25	R
Over 15	E		

In topography with regular slopes land is considered level when the slope is under 2 per cent, and usually requires no special management, unless the internal soil drainage is impeded. All other slope classes require special practices to control soil erosion and to conserve water.

The estimated degrees of erosion that are recognized and mapped are as follows:

Estimated Degree of Erosion	Mapping Symbol
No apparent erosion	0
Into topsoil	1
Into subsoil	3
Into parent material	5

7. Methods of Field Examination

The soil is examined in three ways. All existing road cuts, excavations and holes are first examined. Where the soil is covered by sod it is opened up with a tiling spade. When frequent examinations of the soil at some depth are required, an auger is used to penetrate and bring up samples of soil from a depth of three feet.

Using these methods, soil material is easily examined and classified. Use of the auger reveals the nature of the soil profile. Poorly drained soil is recognized when mottled subsoil or glei is brought up by the auger. Depth of the profile or the extent of any one horizon can be estimated from a graduated scale on the shaft of the auger.

A good estimation of the depth of the parent material is made in limy soils by testing with dilute hydrochloric acid. Effervescence occurs when the acid is applied to material that contains free carbonates of lime or magnesium.

Ordinarily this indicates parent material, since free carbonates do not usually remain in the weathered portion of the profile. However, in the Brown Forest soils, they may appear in the upper horizons, so care must be taken to determine whether or not the leached horizon is present.

Estimation of the degree of erosion can be made by examining the soil profile down to the parent material. The appearance of the soil profile may reveal the extent of erosion or the depth at which parent material is found. Previous examination of soil profiles in locations where there has been little or no cultivation, as in old woodlots or along fence lines, establishes a good average for the depth of a profile. Comparison is then made with all the samples taken. When the soil profile does not definitely reveal that erosion has occurred, any other evidence of erosion is used that proves erosion of at least class 1. Soil cut away on the downhill side of fence rows is good evidence of erosion. When fields are exposed by recent cultivation the establishment of rills or overdeepened drill rows with deposition of sediment downhill is taken as evidence of erosion. Sometimes crop response reveals erosion. It is common to see poor response on the shoulders of knolls and hills due to lack of moisture in the eroded soil.

The establishment of boundaries between kinds of soil or soil conditions is rather more difficult than establishing the existence of the type of condition in the first place. Most of these features merge gradually into each other. Different conditions, however, cause marked differences in response of vegetation. The changes in vegetation growth can be seen in the aerial photograph or in the field. Boundaries are then established where such changes are most marked. Often sharp topographic breaks form the boundary between the different soil conditions.

It will be apparent that observations of this kind are subject to some error. Correction of possible error

is made in the following way. Land to be surveyed is assigned to each pair of men by blocks. When the work is turned in, adjacent blocks are then matched. If classes and boundaries coincide, then it is taken that the observations were correct. If they do not coincide, then the supervisor goes over the boundary in the field along with both parties and a compromise is reached which is believed to be the fairest description of the conditions to be found. There remains some possible error. In reading the map it may be pointed out that conditions may be found in the field that are not accounted for in the map at any one spot. This may be due to a small error in the placing of the boundary or to a small area that was recognized in the field but not big enough to be mapped on the scale of the map used. In the overall figures giving the inventory of soil it may be taken that, as the work was done by a number of observers, errors are compensated.

CHAPTER 4

DESCRIPTION OF SOILS

1. Classification

The formation of the soil is due to the action of weather and vegetation. On this watershed, as in the rest of Southern Ontario, the soil-forming process is that of podsolization, which was described in the introductory section on soils. Most of the soils of the watershed may be grouped together as gray-brown, podsolic soils. However, it will be remembered that the soil-forming process is one of leaching by moisture and acids and the removal of lime and magnesia carbonates. This process is opposed by the presence of limestone. The resulting soil is a compromise between these two influences. It is called a "Brown Forest soil". There is a dark brown topsoil, little or no horizon of leaching and a brown subsoil. The profile is quite shallow.

Brown Forest soils are found sporadically throughout the watershed. There is no pattern to their occurrence, although they are more frequent in the northern sections than in the south. Often the two soil groups are found side by side with no area of transition.

The soil classification used in this report is that set up by the Ontario Soil Survey. The soils have been identified on the basis of physiographic origin - that is, landform and material. The soils formed on one kind of material form an association or catena. Series in a catena are separated on the basis of natural internal drainage. The following is a list of the major soil divisions of the Saugeen.

Great Soil Group	Soil Type	Internal Drainage	Topography and Material
Gray-Brown Podsolic	Harriston loam	Good	Drumlins and till plains, loamy material
	Harriston silt loam	Good	
Gray-Brown Podsolic	Listowel loam	Imperfect	
Gray-Brown Podsolic	Listowel silt loam	Imperfect	
Dark Gray Gleisolic	Parkhill loam	Poor	
Dark Gray Gleisolic	Parkhill silt loam	Poor	
Gray-Brown Podsolic	Pike Lake loam	Good to excessive	Roughly sorted outwash, coarse open material
Brown Forest	Sullivan sand	Good	Kames and outwash material stratified
Brown Forest	Sullivan gravel	Good	
Gray-Brown Podsolic	Donnybrook gravel loam	Good	
Gray-Brown Podsolic	Waterloo sandy loam	Good	Kames and outwash material well stratified
Gray-Brown Podsolic	Burford	Good	Spillways, gravel
Dark Gray Gleisolic	Brisbane	Imperfect	
Dark Gray Gleisolic	Gilford	Poor	
	Muck	Poor	Spillways
	Peat	Poor	Swamps
	Bottom Land	No profile development	River valleys

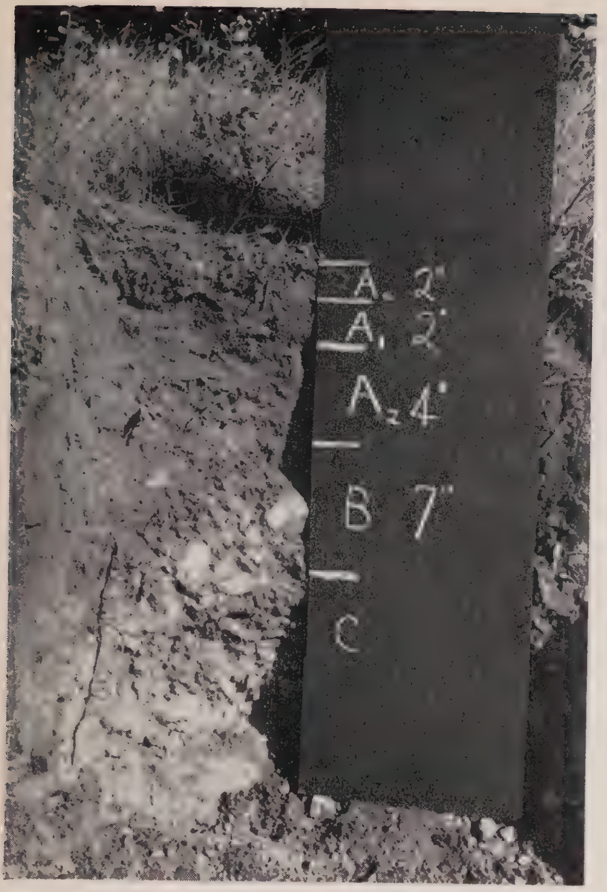
All soils on the Saugeen Watershed have rather shallow profiles, usually below two feet in depth. In other words, there is a definite tendency toward immaturity. This is the result of two factors. The soils are somewhat younger than those of other parts of South-western Ontario. Secondly, the high lime content of the soils has tended to slow down leaching, thereby inhibiting profile development.

2. The Harriston Series

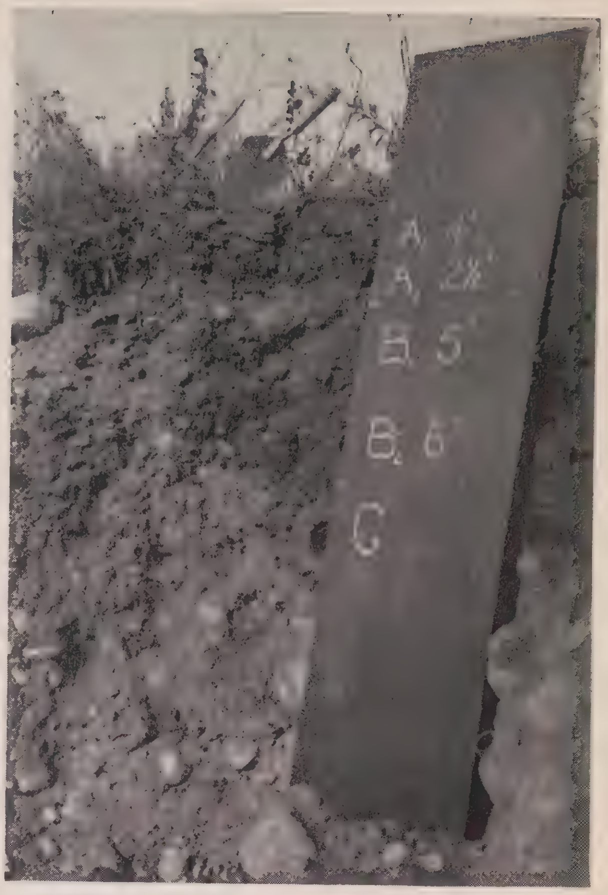
This soil series is characteristic of the Bentinck Whaleback Hills, the Durham and Markdale Rolling Plains, and the Dundalk Silty Plain. In the first three physiographic units Harriston loam predominates, while the Dundalk Plain is largely composed of Harriston silt loam. The topsoil of Harriston loam consists of an A_1 horizon of 4 to 5 inches of grayish-black, crumb-structured loam, underlain by an A_2 horizon of 4 to 6 inches of light yellow structureless loam. Much of the coarser material has been removed from this horizon, leaving it silty in texture. The B horizon, or subsoil, consists of 8 to 10 inches of light brown nut-structured clay loam. Sometimes this horizon becomes rather blocky in structure and breaks up into large aggregates. The parent material is a gray-brown, stony, medium-textured till, which has a high lime content. Harriston loam is variable in stoniness throughout the profile and the stones are of varying sizes. The amount of stoniness also varies according to location, although Harriston soils are rarely excessively stony.

The profile of Harriston silt loam is very similar in appearance to that described above. The difference is that the soil has been developed wholly or partly in silt which has been deposited over the till. Thus the two soil types exhibit a similar profile development in depth and colour, but differ in texture.

Listowel loam and Listowel silt loam are the imperfectly drained members of the Harriston catena. They are marked by shallower profiles, somewhat darker in colour throughout, with the A_2 and B horizons marked by gray and brown mottling. This is caused by a fluctuating water table, allowing brown oxides of iron to accumulate during dry periods and reduced compounds of iron to accumulate during wet periods.



Harriston Loam. This is the most productive soil on the watershed and occurs most extensively on the Bentinck Whaleback Hills.



Sullivan Sand. This is a brown forest soil and lacks a leached A^2 horizon. It is characteristic of the Hanover Sandy Plain.

A soil profile of Donnybrook gravel. Note the coarse, stony nature of the soil.

The inadequate internal drainage limits downward movement of water, giving a shallow profile and a limited development of the A_2 horizon.

The poorly drained member of the series, Parkhill loam, exhibits a still more limited profile development. It consists of black topsoil, very high in organic material, underlain by a sticky gray, slightly mottled material called a glei. This is the result of a permanently high water table. Since the soil is permanently wet, it is of little use agriculturally.

The natural vegetation of the Harriston and Listowel soils is a broad-leafed hardwood forest such as is still found on the steeper slopes of the drumlins. Where evergreens occur they either have been planted or have invaded an area that has been taken out of cultivation. The natural vegetation of the poorly drained Parkhill loams is typically cedar swamp.

Because of the good internal drainage of the Harriston soils and their relatively high lime content, soil erosion is not a serious hazard, except on the steeper slopes of the drumlins. The Listowel soils, on the other hand, because internal drainage is impeded, can erode rather severely if they occur on slopes. At the same time, their productivity is impaired because of the imperfect drainage. They are "cold" soils and do not dry up quickly in the spring unless they are artificially drained.

3. <u>The Sullivan Series</u>

(a) <u>Sullivan Sand</u>

This soil type is extensive on the Hanover Plain and found occasionally in the Glenelg Gravelly Hills. It is a Brown Forest soil, having no evidence of a leached horizon. Sullivan sand profiles are shallow, varying from 10 to 15 inches. The A horizon is a dark brown sandy loam exhibiting a crumb structure when the content of the organic

matter is at a high enough level. The subsoil is often divided into two separate horizons, B_2 and B_3. The B_2 is a dark brown crusty sand, the tendency to cementation being due to deposition of oxides of iron. The B_3 is a yellow-brown fine sand. The B horizon grades indistinctly into the parent material, a grayish-yellow calcareous sand, which shows stratification, indicating that it is water-deposited.

(b) Sullivan Gravel

This soil has a similar profile development to Sullivan sand, except that it contains a high proportion of fine gravel and the horizons are not so distinct. The parent material is a stratified gravel. It has the same general distribution as the Sullivan sand, except that it tends to be confined to the edges of the Hanover Undulating Plain.

The imperfectly and poorly drained members of the Sullivan series occur only in very small localized areas and are not agriculturally significant.

The natural vegetation of the Sullivan series is a mixed coniferous-deciduous forest. Conifers tend to predominate on the sandy knolls.

Because of the free internal drainage of these soils, erosion is not a serious problem if they are well managed. However, the profiles are shallow and unless the organic content is maintained at a high level, they can quickly become exhausted and extremely droughty. In this case wind erosion can be a severe hazard.

4. The Donnybrook Series

Donnybrook Gravelly Loam

This soil type is found in localized areas throughout the Glenelg Gravelly Hills and on isolated kames and eskers throughout the watershed. It is a Gray-Brown Forest soil, exhibiting a partly leached horizon. The profile varies in depth from 12 to 17 inches. The topsoil consists of an A horizon of fine sandy loam with occasional small stones, in

which the mineral and organic materials are well mixed, giving it a very dark gray-brown colour. The A_2 horizon is shallow, only 2 to 3 inches in depth, and is composed of a fine gravelly loam, in which definite layering is visible. It is yellowish-red in colour and much of the organic matter has been removed by leaching or oxidation. The subsoil of B horizon is a gravelly loam, dark brown in colour. Sometimes two horizons can be detected, the upper one slightly darker than the lower. The parent material of the soil is stratified sand and gravel, and some of the stones appear to have been derived from Pre-Cambrian rocks. A few granite and gneiss stones appear throughout the profile which are foreign to the underlying bedrock. Donnybrook sandy loam is found on kames which are largely composed of sand. The Donnybrook soils exhibit a coarse open structure that allows free penetration of water, and are somewhat droughty. Since the slopes associated with them are often steep, erosion can be a problem if they are intensely cultivated. However, the rough topography often limits cultivation and large acreages of these soils remain in pasture and forest.

5. <u>Pike Lake Loam</u>

This soil type is closely associated with the Glenelg Gravelly Hills and the Saugeen Swampy Flats. The materials from which these soils are derived vary greatly. Sometimes they are stratified and sometimes they are not. Regardless of the mode of deposition of the parent material, the profiles are all very similar in appearance. They are shallow, coarse and excessively stony. Sometimes the profiles are only a few inches deep. The stones are usually ungraded as to size, varying from large boulders to small pebbles. These soils have a low organic content and are rather infertile and droughty. The topography associated with them is rough and broken and this combined with their excessive stoniness makes cultivation very difficult. Therefore, much

of the area covered by this land type is in forest or supports very poor pasture. A similar type of soil to Pike Lake loam, but belonging to the Brown Forest group, is also found in some parts of the watershed. It is called Osprey loam. The profile is the same except that a horizon of leaching cannot be detected. Both soils are almost structureless in the upper horizons, with a slight tendency to crumb structure in the subsoil. The stones tend to become encrusted with lime.

6. Waterloo Sandy Loam

This is a characteristic light-textured soil found particularly on flanks of the kames south of Allan Park and its distribution on the watershed is therefore limited. Waterloo sandy loam has a loose black topsoil which shades into a pale yellow dusty sand. The subsoil is bright yellow shading into brown and is underlain by gray stratified sand of the parent material. The parent material is quite high in lime, although it has been leached completely out of the profile.

The soil is well drained, light and easy to cultivate. It is a "warm" soil and can be worked early in the spring. However, since it is a light soil, the organic material is soon "burned" out under cultivation and requires constant replenishment. On the steeper slopes, erosion can be a severe hazard, thereby increasing the tendency to drought.

Despite its disadvantages, this soil type is extensively cultivated. It is more fertile than the accompanying gravels and in addition is much easier to cultivate. Properly managed and fertilized it can produce excellent crops.

7. Burford Gravel

This soil type is confined to the Saugeen Swampy Flats, on the better drained fringes. The parent material is a well stratified gravel, deposited through the action of glacial meltwater streams. The topsoil is usually a mixture of

sand and gravel with enough organic matter to produce a loamy texture. The subsoil is a dark brown stratified gravel and is often slightly cemented to form a hard layer.

Burford gravel has a very restricted occurrence and due to its proximity to swamps is often left either in forest or pasture. However, it responds to cultivation better than do the coarser soils. The areas covered by this soil type are often valuable sources of gravel.

Where the drainage in the Flats is poor a soil called Gilford loam is found. It is developed on the same parent material as the Burford, but is constantly wet. The profile is shallow and consists of a surface layer of black decomposed organic matter, underlain by a stony, sticky gray horizon, slightly mottled with red, called a glei. Again the stratification of the gravel is evident. These soils cannot be drained adequately and therefore remain in forest cover, mainly cedar swamp.

8. Peat and Muck and Bottom Land Soils

In areas of poor drainage, in depressions, the bottoms of spillways, and in inter-drumlin areas, the excess moisture slows down decomposition of plant matter so that there are considerable accumulations of muck and peat. Since they are poorly drained, they are used mostly for summer pasture and for woodland.

Where the main streams and some of their tributaries flow through broad valleys, the valley bottoms are subject to floods, especially in the spring. The soils in these valleys are silty and covered with recent deposits of sediments, so that there is little or no profile development. They therefore cannot be assigned to any particular soil zone. They are also poorly drained. Because of the poor drainage and periodic flooding these soils are unfit for regular cultivation and are usually covered by pasture or woodland. They are lumped together under the general term of bottom lands.

CHAPTER 5

PRESENT LAND USE

1. Type of Agriculture

Farming on the Saugeen Watershed is mainly of the mixed farming type. That is, the farm income is usually derived from more than one source. Cattle-raising is probably the most important of these sources. Cattle-raising serves two functions, beef production and cream production. Only a very few farms are devoted primarily to the production of fluid milk, and they are confined to the areas near the towns of Hanover and Durham and the village of Markdale.

Farm incomes are supplemented by hog-raising and poultry-raising, and in some cases, sheep-raising. A few farms specialize in poultry farming, notably turkey-raising. There are few examples of cash cropping on the watershed. Some wheat is grown around Hanover and Edge Hill and flax is grown sporadically throughout the area, especially in Glenelg Township. Clover seed is also produced as a cash crop. Census figures are not obtainable for a watershed area, but since the Townships of Glenelg and Bentinck are almost entirely within the watershed, it is possible to obtain a good picture of the agriculture by referring to the census figures of these two townships.

In the Census of 1941, there are 936 occupied farms listed in Bentinck and Glenelg. Further breakdown on farm types cannot be derived from the census but the figures on farm conditions, crops and livestock indicate that income is derived mainly from livestock, sometimes supplemented by forest products.

2. Crops and Livestock

Again, the agricultural census of 1941 for Glenelg and Bentinck Townships may be used as a guide to the overall picture of agriculture on the watershed. There were over 47,000 acres of field crops in the two townships, of which hay made up nearly one half. Oats has the largest acreage of

The chief grain crop on the watershed is oats, like this good field in Glenelg.

Hay occupies a large acreage of the individual farms.

Much of the rougher land of the watershed is left in unimproved pasture. Improvement of these pastures would greatly increase the carrying capacity and afford more protection to the soils. Artemesia Township.

the grain crops, with mixed grain, wheat and barley following in that order. However, these three crops combined occupy only three-quarters as much land as oats. Rye, flax, fodder crops (corn, etc.) and potatoes occupy a very limited acreage.

There is about the same amount of land in pasture as there is in field crops. Over half the pasture is classed as unimproved land, that is, not fit for the plough. Woodland and marsh occupy over 37,000 acres of the unimproved land.

The figures on cattle are rather more difficult to evaluate. Cows and heifers (over one year) are slightly in excess of those kept for beef and young stock (10,000 to 9,000). However, these figures do not always include stockers which are bought for either winter or summer feeding. There are only about 4,500 cows milked in the two townships. The number of cattle per square mile is low compared to some of the other townships of Ontario. The number of sheep and swine listed in the 1941 census is also low, 7,800 sheep and 8,600 swine. The 1951 census should show a considerable increase in the number of swine, due to increased production during the war and the relatively high price of pork since the war.

3. Pasture Study

A study of existing improved pastures on the watershed was made in order to obtain information of the measure of success in the establishment of pastures under different soil conditions. The study included type of mixture used, soil type, slope and drainage, management, carrying capacity and length of time seeded down. To get a comparison, some unimproved pasture farms were studied.

There are a number of long-term improved pastures in existence on the watershed, the majority of which have been quite successful. The largest operator is Mr. Wes Magwood at Hanover, who has three plots which have been seeded down for

varying lengths of time. The soil type is mainly Sullivan sand, but despite the tendency to summer drought on this soil, the plots maintain a good growth throughout the season. One plot has been seeded down for six years and still produces a heavy sod and large quantities of fodder. The most successful mixture has been orchard grass, brome grass, meadow fescue, Kentucky blue grass, Canada blue grass, ladino clover, red clover and alfalfa.

The plots are manured and fertilized regularly in spring, fall and winter. Phosphate at the rate of 200 pounds per acre together with a concentrated nitrogen fertilizer is added in the spring and 200 pounds to the acre of 0-12-20 fertilizer in the fall. The plots are clipped regularly to coarse growth and to keep down the weeds. It has been found on these plots that the red clover disappears after the second year and that the alfalfa becomes very thin after three or four years.

Mr. Neil Aldcorn, Priceville, has established a very successful pasture on rough hummocky land, which had been rather seriously eroded. The soil type is Donnybrook gravelly loam, which is light and well drained and tends to be droughty in the summer. Unimproved pastures in the same area are usually dried up and brown by the middle of July.

The mixture used in this pasture is orchard grass, brome grass, Kentucky blue grass, alfalfa, ladino clover and white dutch clover. It has been seeded down for four years and has a carrying capacity of two head of cattle per acre, until September. The pasture is clipped regularly and manured during the fall and winter. 12-48-24 fertilizer is applied at the rate of 60 pounds per acre in the spring. The pasture is not grazed late in the fall, so as to allow a good growth before winter to prevent winter killing.

Mr. Jack Brady, Markdale, has a successful long-term pasture which has been seeded down for six years. The soil type is a light Harriston loam which is very stony and the

land is too hilly to be economically cultivated.

The mixture used here is slightly different from the preceding one. Timothy has been substituted for white dutch clover and Canada blue grass has been added. This pasture carries 16 head of cattle on 16 acres all summer. The area is divided into four-acre plots and grazed in rotation. Cattle are put on the pasture the first or second week in May, always a week before the neighbouring cattle. They are taken off early in the fall to allow for pre-winter growth. The pasture is manured in the fall and fertilized in the spring with 100-200 pounds to the acre of 2-8-12 or 2-10-12 fertilizer.

By contrast, the unimproved pastures studied have a much lower carrying capacity, averaging about one head to four acres. All are becoming badly infested with weeds and the desirable species of grass have been largely killed out. All suffer from drought during the summer months.

The study indicates that the establishment of long-term improved pastures is quite feasible on the watershed. All operators are satisfied with their pastures and feel that the extra costs of management are more than compensated for by the added returns. The establishment of long-term improved pasture is one of the best soil conservation practices which can be adopted on the watershed.

4. Land Use Mapping

Five classes of land use were recognized and mapped on the land use survey. They were as follows:

(a) Cultivated - field crops, pasture, hay or fallow, included in a crop rotation.

(b) Pasture - unimproved land used for grazing, "wild" pastures and pastures which had been seeded down for more than five years (that is, longer than an ordinary crop rotation period).

(c) Woodland - forest which is recognized as woodland in the forestry survey.

(d) Idle land - not carrying woodland and unsuitable or unused for cultivation or pasture.

(e) Urban land - contained within municipalities or built up.

Land use was mapped on a reconnaissance basis by blocks. The land use was observed and the percentages of each estimated. In preparing the map, each block was assigned to a class as follows:-

Cultivated - more than 60% cultivated

Pasture - more than 60% pasture

Forest - more than 60% forest

Since idle land is not extensive on the watershed, it was not included as a class.

Cultivated and pasture)
Cultivated and forest) When any two
Pasture and forest) add up to 60%

Cultivated, pasture, forest and idle - where no two classes add up to 60%.

The largest class of land use on the watershed is that of cultivated and forest. It is prevalent throughout the Holland Ridge, the Bentinck Whaleback Hills and the Glenelg Gravelly Hills, and indeed forest dominates in many of the blocks throughout these areas. Cultivated blocks tend to be confined to the Hanover Rolling Plain and the Durham, Markdale and Dundalk Plains. Blocks of pasture or pasture and forest are more widely scattered. The land use map clearly shows that climatic and soil conditions of the watershed are such that forestry is still an important factor in the land use of the watershed. At the same time it masks the importance of pasture and sod. The census figures clearly show that hay and pasture far outnumber all other crops in total acreage. The great extent of sod and the importance of livestock on the farms are both features which favour soil conservation. Increase in agricultural production and protection of the soil both depend on accepting the basic principles of livestock and sod. Where land must be cultivated for corn, roots, grain or cash crops, it must be protected against erosion and its fertility and organic content kept up. A balance between high yields of field

crops, without robbing the soil, and good pastures is the summary of soil conservation from the farm point of view. From a regional point of view, the withdrawal of some land from agricultural use and putting it back into forest with the view of harvesting a crop of timber is the chief principle.


PRESENT LAND USE
1951
AREAS COVERED MORE THAN 60 PERCENT BY EACH LAND USE OR COMBINATION OF USES
L CULTIVATED
LP CULTIVATED & PASTURED
P PASTURED
LF CULTIVATED & FORESTED
PF PASTURED & FORESTED
LPFX MIXED USE
F FORESTED
SCALE: MILES
1 1/2 0 1 2 3 4 5
MARKDALE
PRICEVILLE
DURHAM
Gravel Pit
HANOVER

CHAPTER 6

CONSERVATION PRACTICES

Conservation means using and managing land according to its use capability. It emphasizes management to combat the loss of water and soil erosion, and at the same time to maintain good crop yields. The various methods used to this end are herein described.

1. Crop Rotations and Cover Crops

The most effective means of combating water loss and soil erosion is the maintenance of good soil organic content. Soil with organic content absorbs water and retains it and makes soil fertility readily available to plants. Organic matter is commonly added by crop rotation, application of animal manure and the ploughing under of a crop of clover or grass as green manure. Trash, stubble and straw also play their part if nitrates are added to aid in their decomposition.

Grains and intertilled crops such as corn or potatoes are classed as soil-depleting crops while grasses and legumes are classed as soil-building crops. The legumes combine nitrogen from the air into the soil and the grasses leave the remains of their root systems in the soil and when the sod is ploughed under some of the vegetation is turned into the soil to enrich it. The decaying vegetation improves the soil structure and provides a sponge which absorbs water readily.

In the areas which are more susceptible to erosion and on which the slopes are too irregular to practise contour cultivation and strip-cropping, it is usually better to extend the crop rotation so that the land is cultivated only once in four years or more. The extra strength built into the soil during the years it is under the grass cover will make it much less susceptible to erosion when it is cultivated, and yields of cultivated crops are increased. Under this system intertilled crops should be kept to a minimum on the sloping land.

Much of the sheet and rill erosion takes place in the fall after ploughing is completed or in the spring before the crop is established. This condition can be controlled by vegetative cover, and where land is under sod or is planted with winter grains, this is accomplished automatically. It is advisable, on land which might otherwise be left fallow over winter, to seed to a winter cover crop such as rye. Winter cover crops protect the land against erosion and constitute a means of adding organic matter to the soil. The difficulty is that the winter cover crop must be planted early in the fall so that it will be far enough advanced by the first frost to be really effective. This cuts down the number of fall cultivations and creates a problem of tillage during a late spring.

2. Improved Pasture

Long-term improved pasture is applicable on land which is too rough and eroded to be economically cultivated. It is especially applicable on light soils which quickly lose their fertility under continuous cropping. Good pasture serves two functions; it acts as a soil-building agent, increasing soil fertility; and secondly, the thick grass cover protects the soil from erosion by slowing down the surface run-off of water and allowing it to seep into the ground. A good improved pasture is an economic asset to a farm and is reflected in the production of beef and milk. To establish long-term improved pasture, good preparation of the seed bed is essential. Weeds may have to be eradicated by spraying before the old sod is broken up. The area should be cleared of boulders and of any brush and small trees. The old sod must be broken up and re-seeded to a good pasture mixture, the major species of which are capable of remaining productive in the ground for a long time. Manure and commercial fertilizer should be applied to give the young seedlings a good start. Seeding may be done

either with a cyclone seeder or the seed drill, using the clover seed box for the small seeds and the grain box for the larger seeds. The spouts should be removed from hoes in order to get a broadcast effect and to avoid deep planting. The common practice is to seed a nurse crop along with the pasture mixture in order to protect the young seedlings.

There is little information to be had on pasture renovation in Ontario. Some good results have been obtained by applying fertilizer to existing pastures and clipping regularly to keep down weeds. In this way a thick stand of grass has been established. This type of management may be used to good advantage where the land is too rough to be tilled. It is especially applicable on light soils, but cannot be used to advantage on heavy soils where subsoil compaction has taken place.

Good management is essential to the success of any long-term improved pasture. The pasture should be fertilized with commercial fertilizer in the spring and should be top-dressed with five to ten tons of manure per acre in the spring and fall. Grazing must be controlled, so that it is neither overgrazed nor undergrazed. It is a good practice to divide the pasture into plots and graze them in rotation. Regular clipping is essential to control weeds and to prevent rank, coarse growth. This should be done at least twice during the season, once for early and once for late weeds. The mowing should be done before the weeds go to seed.

On farms that are more seriously eroded the establishment and maintenance of good pasture is the most important single remedy. Complete instructions on pasture mixtures and the establishment and maintenance of pastures may be obtained from "Better Pastures in Eastern Canada", published by the Department of Agriculture, Ottawa, and from "Better Ontario Pastures" and "Good Seed Mixtures for Hay and Pasture in Ontario", published by the Ontario Department of Agriculture. Advice and assistance can also be obtained from the County Agricultural Representative.

3. Contour Cultivation and Strip-Cropping

The principle of contour tillage is that each furrow or drill row, being "on the level" instead of up and down, acts as a tiny dam and checks the downhill flow of water. Furrows, drill rows or even the tracks of implements running up and downhill channel the water downhill. The rapidly moving water soon gouges out rills. These are often seen after a heavy rain or, more commonly, during the spring thaw. These rills are smoothed out with subsequent cultivation, but nevertheless some soil is lost. Some of the rills may grow into gullies. By cultivating on the contour this difficulty is overcome and the water penetrates the soil instead of rushing down slope to be lost, taking good topsoil with it.

On very gentle slopes, cultivation across the slope will usually suffice. However, with the steeper slopes contour cultivation must be combined with strip-cropping. By this principle alternate bands of cultivated and sodded land are laid out across the slope. Some surface run-off will occur on the cultivated land regardless of the way in which it is cultivated and the sod strips, therefore, act as buffers and pick up any soil eroded from the strips next to them. At the same time, the grass cover builds up the organic content of the soil and thereby adds to its fertility. When there is more organic content in the soil, absorption and retention of water is increased and erosion decreased. In practice it is necessary to have crop rotations which include two years of sod for every two years of grain or corn, as for example, hay, hay, corn, oats. Thus the cultivated strip is left open for two years, while the sodded strip remains under grass for two years. Half-way through a four-year rotation the sod is ploughed up and the cultivated strip is seeded down to hay.

Contour cultivation and strip-cropping are only applicable on long smooth slopes, such as are found on the Bentinck Whaleback Hills. There is a further disadvantage to

contend with in this area. Much of the land on these hills was bouldery and stone fences were commonly built of boulders removed from the fields. Therefore in order to lay out the contour strips it would be necessary to remove these fences by means of a bulldozer, which would add greatly to the expense of instituting a farm plan incorporating contour strips. Once a farm is set up for this type of farming the land becomes easier and cheaper to work, especially with mechanized equipment. Contour cultivation is much more economical of power than the conventional method. Tests have been made of this type of farming which show that operating costs have been lowered and returns increased in the first few years of operation.

4. Terraces

A diversion terrace consists of a channel running across the slope which may be cultivated or left in grass. This intercepts overland flow of water about half-way down a slope and diverts the flow along the contour. The outlet of the terrace should lead to a grassed watercourse along which water can be carried safely downhill.

Diversion terraces may be constructed along with a system of strip-cropping to break up long, smooth slopes, They may also be used to break long slopes which are too irregular to be strip-cropped. This device by itself can commonly be used and should be sufficient to check a good deal of soil and water loss on land that does not lend itself to systems of contour cultivation.

Any practice carried out on the contour should be undertaken only under direction of a trained agricultural engineer or soil conservationist. Faulty layouts may lead to trouble, and failure of a scheme purporting to be for soil conservation can seriously prejudice people against it. Once these practices are thoroughly understood in a district and men are available who are experienced in them, the need for technical assistance lessens and only guidance and inspection

by professional people are necessary. In this regard, the setting up of a demonstration farm serves two purposes. It proves the worth of this type of farming to the district and also gives experience to local people in the methods of conservation farming.

5. Grassed Waterways

By this method, all definite watercourses, that is, watercourses which carry water in the spring and after heavy rains, are kept under permanent sod. The sod checks erosion and gullying. Silt, which may be washed from bare earth, is trapped by the grass and its fertility is not lost to the farm. Clear water is delivered into the streams to the benefit of fish and wildlife and other users of water.

The grass which grows on the waterways can be cut and used for hay. It is worth while to leave a wide enough strip to run a mower up and down. The grass can be expected to grow well because of the fertility added to it each year by the soil washed from the field.

6. Gully Control

Gullies are not extensive on the watershed. Some are in the form of erosion scars on steep slopes which have been aggravated by wheel tracks, cattle paths or dead furrows running up and down hill. Others are due to headward erosion of intermittent streams. Besides the loss of good topsoil, speeding up the run-off and adding silt to the streams, ditches and reservoirs, these gullies have the further disadvantage of obstructing the tillage of fields crossed by them. Some gullies are small enough to be checked by cultivation and seeding to grassed waterways. Larger gullies may need check dams to hold back the water and allow the gully to gradually fill up again. Alternatively, the gully may be filled with brush and earth graded over it. Re-excavation can be prevented by several methods. Interceptor ditches, terraces or drains may be used

to carry the run-off away from the head of the gully or tile drains may be laid along the bottom before back filling takes place.

If a gully is too large to be completely filled up and returned to cultivation, it should be rendered harmless and protected by trees, shrubs and good sod cover.

7. Drainage

Soils which suffer from poor internal drainage cannot be brought to maximum production unless they are artificially drained. Plants need both air and water for proper growth, but if the soil is full of water, most of the air will be driven out and the plants will suffer from lack of oxygen.

In most imperfectly drained soils, the soil water table is high in the spring and drops later in the season. For this reason, seeding is usually late and the plants themselves develop a shallow root system. Then when the water table drops later in the season they may actually suffer from drought.

This condition can be overcome by the installation of tile drains. By this method the excess "gravitational" water is removed, leaving only the "capillary" water in the small spaces between the soil particles. At the same time the soil organic matter should be maintained at a high level by means of barnyard and green manure to improve the soil structure. A high organic content allows the soil to absorb moisture without becoming waterlogged. Where tile drainage is not possible, wet soils can be somewhat improved by this method.

Drainage of wet soils requires an adequate outlet for tile, which usually is accomplished by constructing ditches leading to watercourses. Sometimes this is impossible due to topographic difficulties. If this is the case, land use on the wet soils must be such as to take their limitations into account. This means concentration on grasses and legumes tolerant of moist conditions and a reduction of grain acreage.

By-pass pond, Glenelg Township. This pond should be fenced from cattle to maintain its usefulness.

Spring-fed pond, Bentinck Township.

Pond on a permanent stream. Headquarters, Grey County Forest.

8. Woodland Management

Forestry on Authority-owned lands and on farms is fully discussed in the Forestry Section of this report. Reforestation and woodland management are desirable on farms and are important features of river valley management.

Due to climatic, soil and physiographic factors, forestry is one of the most important land uses of the watershed. In addition to the land designated for acquisition by the Authority, a good deal of private reforestation is indicated as well as improvement of existing woodlots. Cattle should be excluded from woodlots in order to promote a good undergrowth and to allow for the re-seeding of hardwoods. The loss of pasture acreage by reforestation and woodland management can be compensated for by the establishment of long-term improved pasture.

9. Farm Ponds

Good management of water resources requires holding water as much as redistributing surplus water. One aim of soil and water conservation is to hold moisture in the soil. Also important is adding to ground-water supplies and conserving water in surface reservoirs wherever feasible.

A multitude of surface reservoirs can materially increase the water which soaks through the soil into ground water and can also hold back the streams. These surface reservoirs can be in the form of farm ponds. Ponds are usually built for specific needs - fire protection, stock watering, domestic or barn supply, recreation and so on. The cumulative effects of many ponds on ground water and stream flow would be a benefit to all.

A bulletin on farm ponds is available from the Saugeen Valley Conservation Authority or from the Department of Agriculture. Six types of ponds are described, the dug-out, spring-fed, by-pass, run-off and ponds formed by permanent dams

and temporary dams on permanent streams. Four of these types have a special application to the Saugeen Watershed - the dug-out, the by-pass, spring-fed and the pond on a permanent stream.

CHAPTER 7

LAND USE CAPABILITY

1. Basis of the Classification

The use capability of the soil depends on its natural, inherent characteristics. It can be judged in two ways: first, from the experience of those who have operated it for generations; and second, from the knowledge of the characteristics of soil obtained by scientific analysis. The present land use patterns express pretty well the experience of farmers on the soils for at least 100 years. This gives the first clue to a comparative rating of capabilities. On the other hand, economic pressure, lack of technical knowledge or mere geographic location may have led farmers into using land in a way which slowly and insidiously wastes its resources. Therefore, to the knowledge of the worth of soils gained locally there may be added whatever is known regarding soil erosion and fertility depletion and methods for controlling them.

2. Derivation of Capability Rating according to Present Use

To determine the use of each kind of soil an area through the middle of the watershed was studied in detail. This area was chosen in such a way as to give a fair sample of all soil types and relief conditions encountered on the watershed. To facilitate mapping, the decimal system of soil classification was employed. Under this system soils are classified as to the mode of deposition of the parent material, the chemical composition of the parent material, and the natural internal drainage of the soil. These factors are listed by numbers and the soil type is designated by a combination of three numbers.

Mode of Deposition

1 - light till

2 - medium till

3 - heavy till

4 - poorly stratified sand and gravel

5 - well stratified sand and gravel

6 - lacustrine (water-deposited) silt and clay

Chemical Composition

8 - Parent material high in lime (universal on the watershed)

Internal Drainage

1 - excessively drained

2 - well drained

4 - imperfectly drained

6 - poorly drained

Under this system the number 282 indicates a soil developed on a medium till, high in lime and well drained. This corresponds to Harriston loam. The following table gives the soils found on the detail strip, classified according to the decimal system and their equivalent names designated by the Ontario Soil Survey. Some of the imperfectly and poorly drained members of the soil associations occur only in restricted areas and hence are not named by the Survey.

Decimal Classification	Soil Name
182	Pike Lake loam
282	Harriston loam
284	Listowel loam
286	Parkhill loam
482	Sullivan sand
482g	Donnybrook gravel
484	
486	
486gAO	
582	Waterloo sandy loam
582g	Burford gravel
584g	Brisbane gravel
586g	Gilford gravel
682	Harriston silt loam
684	Listowel silt loam
686	Parkhill silt loam

All these types of soil were recognized on the detail strip, totalling 30,108 acres. These are all soils which are used to a greater or lesser extent for agriculture. Slightly over 50 per cent is cultivated, the remainder is fairly evenly divided between pasture and woodlots, with a small proportion idle or covered by building lots.

PROPORTION OF PRESENT LAND USE ON TYPES AND CONDITIONS OF SOIL

Mapping Symbol	Cultivated %	Pasture %	Forest %	Idle %	Total Acres
182B1	58.6	25.7	12.2	3.5	675
182M1	67.6	17.8	11.9	2.7	1,247
182N1	47.2	30.8	20.9	1.1	866
182P1	15.1	32.0	48.7	4.2	1,253
182R3	8.8	39.5	51.3	0.4	362
186A0	68.2	15.3	9.4	7.1	169
282A0	83.7	9.0	5.6	1.7	1,569
282B0	69.3	16.6	11.6	7.5	541
282B1	86.1	9.7	4.1	0.1	1,679
282C3	71.4	16.3	11.3	1.0	546
282M0	46.8	18.2	34.3	0.7	964
282M1	68.1	19.6	11.8	0.5	1,230
282N3	44.0	38.4	17.0	0.6	775
284A0	57.0	29.1	13.1	0.8	917
284B1	70.0	22.0	8.0		245
286A0	12.7	52.7	34.6		243
482A0	80.2	11.2	8.6		314
482B3	64.4	17.8	17.8		241
482M1	82.0	11.9	3.1	3.0	587
482N3	75.0	12.1	12.5	0.4	337
482gA0	85.1	5.0	9.2	0.7	359
482gM0	76.7	11.4	11.9		538
482gM1	70.0	16.5	13.2	0.3	1,225
482gN1	46.9	30.9	21.7	0.5	863
486gA0	46.9	24.6	25.4	3.1	497
582M1	79.0	6.5	13.9	0.6	215
584A0	40.5	43.9	13.8	1.8	116
582gA0	61.9	28.9	7.1	2.1	394
582gM1	66.7	17.7	13.9	1.7	388
584gA0	44.6	36.3	19.1		121
682A0	80.8	17.7	1.5		391
682B0	77.3	17.6	3.8	1.3	566
682M1	81.3	18.7			182
684A0	78.0	16.8	5.1	0.1	1,791
684B0	76.3	18.0	5.1	0.6	627
686A0	49.3	27.3	20.7	2.7	934
Muck	5.7	16.9	73.0	4.4	4,876
Bottom Land	11.2	43.0	44.5	1.3	993
Urban					204
Water					78
Total	51.9	20.5	24.9	1.5	30,108

On most of the soils listed there is a fairly good correlation between the use and the capability, although some of the acreages are too small to be considered good statistical samples. In the case of the soils of the Glenelg Gravelly Hills, 182B1, 182M1, 182N1, 182P1 and 182R3, only two are cultivated to a greater extent than the average for the sample strip. In addition, the extent to which they are cultivated is in proportion to the degree of slope and the

severity of the erosion, being 58.6, 67.6, 47.2, 15.1 and 8.8 respectively. The same thing holds true for the 282 group, which is found in the Bentinck Whaleback Hills, although their percentage cultivation is well above that of the sample strip. An interesting correlation appears in this group: 282B0 shows a considerably lower extent of cultivation than does 282B1, but a higher percentage of pasture and forest. The absence of soil erosion in the first case can probably be accounted for by the greater acreage of grass and trees.

Although the steeper land and the more severely eroded soils are recognized as being less suitable for cultivation, an analysis of the table shows that they are, nevertheless, cultivated. This is where farm planning for soil conservation would be a good thing. The milder slopes can be protected from erosion by planting on the contour and in strips, or by extended rotations. Steeper slopes can be protected by maintaining them under sod for pasture. A good example of this practice on the watershed is a demonstration pasture seeded by Mr. Neil Aldcorn in co-operation with the Grey County Crop Improvement Association.

Most of the soils which have a high proportion under cultivation can be assumed to have a high capability rating, although some of them require some degree of protection against erosion or depletion. To set up a "capability rating" of the soils on the basis of present use, a simple calculation was made. The percentage of the soil which is cultivated was divided by 51.9, the percentage of the total area cultivated. For example, a soil with the mapping symbol 282C3 which is 71.4 per cent cultivated gives $\frac{71.4}{51.9}$ or 1.37. This was done for all the soils on the sample strip on which the acreage was considered to be a good statistical sample and these were listed in order of their capability rating.

3. Capability Rating

In the following table is a list of the soils of the sample strip in order of their capability rating, based on present uses with notes on their advantages, disadvantages and

proposed conservation farming practices and treatment with fertilizers.

The figure given beside each type is obtained in the manner described above, that is, the percentage of the land type which is cultivated is divided by the average cultivated land (51.9). This may be called a "preference factor". A soil which is cultivated to the same extent as the average will have a factor of 1.0. Soils with factors greater than 1.0 are "preferred" by farmers in proportion to the factors and those less than 1.0, that is, cultivated less than average, have not been found, in the light of past experience, as suitable for cultivation. In many instances they are cultivated only where the operator has no better land to use. The preference factor gives a rough guide to the capability rating of the soil.

LAND USE CAPABILITY

Symbol	Rating	Description	Advantage	Disadvantage	Proposed Treatment
282B1	1.65	Well drained loam, gently sloping, slightly eroded	Fertile, easily worked soil	Erosible	Contour Cultivation, grassed waterways
482gAO	1.63	Well drained gravelly loam, flat, uneroded, warm & early	Warm soil, easily worked	Low organic content, tendency to summer drought	Soil-building crops
282AO	1.61	Well drained loam, flat to very gently sloping, no erosion	Fertile, easily worked soil	None	No special measures required
482M1	1.57	Well drained sandy loam, irregular slopes, slightly eroded	Warm, easily worked soil	Light soil, low organic content, erosible	Extended rotations, soil-building crops
682AO	1.55	Well drained silt loam, flat, uneroded	Fertile, easily worked soil	None	No special practice required

LAND USE CAPABILITY

Symbol	Rating	Description	Advantage	Disadvantage	Proposed Treatment
684AO	1.5	Imperfectly drained, silt loam, flat, uneroded	Fairly heavy, fertile soil	Cold, wet and late	Tile under-drainage where feasible. Soil-building crops to keep organic content at high level and sustain good soil structure.
684BO	1.47	Imperfectly drained silt loam, gently sloping - no apparent erosion	Fertile	Cold, wet and late	Tile under-drainage where feasible. Soil-building crops. Simple measures to prevent any possible erosion.
482gMO	1.47	Well drained, gravelly loam, irregular slopes, no apparent erosion	Warm soil, easily worked	Low organic content	Soil-building crops
282C3	1.37	Well drained loam, moderately sloping, moderately eroded	Fertile, easily worked soil	Erosible	Contour cultivation, winter cover crops
482gM1	1.34	Well drained gravelly loam, irregular slopes, slightly eroded	Fertile, easily worked soil	Low organic content, erosible	Extended rotations, soil-building crops
282BO	1.33	Well drained loam, gently sloping, no appreciable erosion	Fertile, easily worked soil	Low organic content, erosible	Simple measures to prevent any possible erosion
282M1	1.31	Well drained loam, irregular slopes, slightly eroded	Fertile easily worked soil	Low organic content, erosible	Extended rotations, winter cover crops
182M1	1.3	Well drained, stony loam, hummocky topography, slightly eroded	Fertile easily worked soil	Low organic content, erosible	Extended rotations, soil-building crops

LAND USE CAPABILITY

Symbol	Rating	Description	Advantage	Disadvantage	Proposed Treatment
682BO	1.29	Well drained silt loam, gently sloping, no apparent erosion,	Fertile, easily worked soil	May be eroded under continuous cropping	Simple mechanical measures to prevent erosion
582gM1	1.28	Well drained gravelly loam, irregular slopes, slightly eroded	Fertile, easily worked soil	Low organic content, erosible	Extended rotations, soil-building crops
482N3	1.25	Well drained sandy loam irregular, steep slopes, moderately eroded	Warm soil easily worked	Light soil low organic content, erosible	Extended rotations, soil-building crops, permanent vegetation on the steeper slopes
582gAO	1.19	Well drained gravelly loam, flat, uneroded	Warm soil, easily worked	Low organic content	Soil-building crops
182B1	1.12	Well drained stony loam, gently sloping, slightly eroded	Dries up quickly	Tendency to droughtiness, low fertility shallow profile, erosible	Contour cultivation, soil-building crops
284AO	1.09	Imperfectly drained loam flat, uneroded	Fertile soil	Cold, wet and late	Tile underdrainage where possible. Extended rotations to maintain a high humus content
686AO	.95	Poorly drained silt loam, flat, uneroded	None	Cold and wet	Permanent vegetation, sod or forest. Tile drainage in limited areas where feasible.
482gN1	.903	Well drained, gravelly loam, irregular, steep slopes, slight erosion	Warm soil, easily worked	Low organic content, erosible	Extended rotations, soil-building crops. Permanent vegetation on the steeper slopes.
486gAO	.903	Poorly drained gravelly loam, flat uneroded	None	Cold and wet	Permanent vegetation

LAND USE CAPABILITY

Symbol	Rating	Description	Advantage	Disadvantage	Proposed Treatment
282MO	.9	Well drained loam, irregular slopes, no appreciable erosion	Fertile, easily worked soil	Erosible	Simple measures to prevent erosion
182N1	.9	Well drained, stony loam, rough, steep slopes, slightly eroded	None	Tendency to droughtiness, low fertility, shallow profiles, erosible, difficult to cultivate	Extended rotations, permanent pasture
282N3	.84	Well drained loam, irregular steep slopes, moderately eroded	Fertile, warm soil	Erosible, some difficulty in cultivating due to steep slopes	Extended rotations, permanent vegetation of sod or forest on the steeper slopes
182P1	.29	Well drained, stony loam, very steep slopes, slightly eroded	None	Erosible, difficult to cultivate	Permanent vegetation, sod or forest
286AO	.24	Poorly drained loam, flat, uneroded	None	Cold and wet	Permanent vegetation
Bottom	.21	Valley bottoms	None	Wet, subject to periodic flooding	Permanent vegetation, sod and trees
Muck	.1	Swamp areas	None	Very wet	Permanent tree cover

Out of the 29 soil types and conditions listed, two-thirds have a capability rating greater than 1, that is, they are cultivated to a greater extent than the average for the watershed. In all cases but one the capability decreases as the slope increases. The one exception is 282AO or Harriston loam, which shows a slightly lower capability than 282B1. This is probably due to the fact that even though both soils are well drained, the slopes tend to warm up more quickly in the spring and therefore rate slightly higher in preference over the flat land.

Excessive stoniness creates problems of tillage. The organic content of such soils is usually low, resulting in low yields. Bentinck Township.

Bouldery soils like this in Holland Township are difficult to cultivate with modern equipment and should be left in pasture or reforested.

Inadequate drainage. These soils must be artificially drained to raise their productive capacity. This is near Proton Station.

The table shows that the Harriston loams and Harriston silt loams are among the most preferred soils of the watershed. The former show a higher capability rating based on preference factor than the latter when they are well drained, but when the drainage is imperfect the conditions are reversed. This may be due to the relatively small acreage of Harriston silt loam as compared to Listowel silt loam, its imperfectly drained associate. The farmer on the Dundalk Plain is rarely able to make a choice, since imperfect drainage predominates.

The sands and gravels also show a high capability rating where the slopes are gentle. However, cultivation of these soils seems to decrease rapidly with the occurrence of steeper slopes. In all cases Pike Lake loam, the 182 group, shows a low capability rating. This is also true for the poorly drained soils, the muck and the bottom land. All the latter soils are therefore of limited agricultural value and it would not be wise to clear any more land of trees in tnese areas. Rather, existing woodlots should be protected from grazing and fire and allowed to grow up and possibly extend by natural seeding. The Pike Lake loams especially tend to dry out when bare, but they will hold moisture to feed springs and streams when covered by good forest. Large acreages of these soils have been recommended for acquisition by the Authority for the purpose of reforestation (see Forestry Section).

The occurrence of boulders is the final limiting factor to the use capability of the soils of the watershed. While the areas in which this condition is evident are not extensive, there are local patches in which the boulders are numerous enough to preclude cultivation altogether. Usually they take the form of large limestone blocks deposited by glacial action, although they are occasionally due to outcrops of bedrock. If boulders are not too numerous, they can be removed with a bulldozer, thereby raising the agricultural capability of the soil. This method is unfortunately rather expensive so that areas of extensive boulderiness would be better returned to forest cover.

4. The Use of the Capability Rating

The last chapter outlines recommended land use on the watershed. The capabilities of the soil, as determined in this chapter and in the detail survey, form the basis of recommended pattern of land use. It should be understood that the recommended use cannot be based entirely on the natural characteristics of the soil. The location of any piece of land with respect to markets for farm products and with reference to other soils may determine its use. The types of management indicated are those which will sustain or increase production without further depletion of the soil.

CHAPTER 8

LAND ECONOMICS

1. Purpose of Economic Studies

The size of farms and their prosperity and efficiency are indications of the capability of the soil. These factors were studied as a help in estimating the soil capability regions.

A conservation program might call for a change in land use in some areas so that use is better adjusted to capability. In some instances forestry might replace agriculture. On the other hand, demonstrations of soil conservation would be promoted in areas where new farming practices would help preserve soil and moisture. Therefore it is necessary to know where the "good" farming land and where the "poor" farming land can be found. The economic studies were carried out to establish these facts.

The findings of a survey of farms cannot be related directly to a map of the soils, because the farms are divided by soil boundaries. A comparison of farms and natural conditions can be made on a regional basis. If, for instance, in a region in which one type of soil predominates, there are found only a few large farms of doubtful efficiency and prosperity, it may be safely concluded that that type of soil is of low capability. On the other hand, if an area is found in which the farms are mostly small but prosperous, and another soil type predominates in the area, that soil can be taken to be one of high capability.

Of course this correlation is not one hundred per cent perfect. A survey of this type must perforce ignore the human factor. The man who owns and operates a farm knows pretty well what kind of soil he has and what its capabilities are. Through wise management a man may operate an efficient farm and make a good profit on a soil of relatively low

capability. On the other hand the occasional poor and inefficient farm may appear in a good soil area, due to unwise and faulty management. The human factor will inevitably produce anomalies in this type of survey.

2. Size of Farms

As a general rule, the size of farm holdings depends on the type of agriculture, the type of soil and the climate. Where soil and climatic conditions are such that fruit farming is possible, a small acreage can support a family. Mixed farming requires a larger acreage, ranching still more and forestry the largest of all. Generally speaking, the poorer the soil, the larger the area required to make a living. Over the years the interplay of natural and economic influences should lead to the point where small holdings are firmly established on good land and large holdings on poor land. Small holdings may be found on areas where the land is not good enough to sustain commercial farms but where a "subsistence" level of farming may be carried out on small acreages and the farm income supplemented by work off the farm such as construction or bushwork.

One factor works against this adjustment to natural conditions. With modern methods of mechanized farming, the natural tendency is to consolidate holdings. The man most able to do this is a prosperous farmer in an area of good soils. The operator whose farm is in a poor soil area is often unable to raise the necessary finances to extend his holdings. Also, consolidation of farms often results in cultivation of only a small part of the increased holding, the rest being retained as pasture. However, very large holdings are generally indicative of a low capability soil.

The size of farms was obtained from township rolls. This information was made available by township officials. The size of individual farms is irrelevant and no report is made

of them here. Farms were found to be of all sizes, but on grouping them together it was found possible to account for them in the following way.

Division	Acres
Small	0 - 120
Medium	121 - 240
Large	241 - 360
Very large	Over 360

On a small-scale map of the watershed each farm was indicated in one of four divisions. When an area could be outlined in which more than 90 per cent of the farms are small, then that area is designated as one of small farms. By the same process areas of medium, large and very large farms were separated. One difficulty arose in this respect. Many of the holdings on the watershed were widely separated. Therefore, if a farmer owned one hundred acres in a small farm area, and another one hundred, five miles away in another small farm area, the consolidation could not be shown. In cases like these, it was assumed the two farms were operated more or less individually.

The map of farm size shows that the holdings are in a considerable state of flux. The small farm, one hundred acres usually, is still in the majority, while small and medium-sized farms make up by far the largest area. There are few farms in the very large class. On the Bentinck Whaleback Hills and the Hanover Sandy Plain, the farms are mainly of the small and medium-sized types. The soils in these areas, sands, gravels and loams, are such that they permit a good variety of crops to be grown. In particular, these areas are the only ones in the watershed in which wheat can be grown as a cash crop.

The Holland Ridge and the Glenelg Gravelly Hills have the most large farms of the watershed, reflecting the lower capability of the soils. An odd feature of the Glenelg Gravelly Hills is the relatively small number of medium-sized farms. The same condition occurs in the Markdale area. In the

FARMS
DISTRIBUTION ACCORDING TO SIZE
SMALL 0 - 120 ACRES
MEDIUM 120 - 240 ACRES
LARGE 240 - 360 ACRES
VERY LARGE - OVER 360 ACRES
COUNTY FOREST
SCALE: MILES
1/2 0 1 2 3 4 5
MARKDALE
PRICEVILLE
DURHAM
Gravel Pit
HANOVER

A first-class farm on a whaleback hill in Bentinck Township.

A first-class farm in Glenelg Township.

A good farm in Glenelg Township.

Dundalk Plain, the farms are again medium to small in size. However, throughout the watershed it is very difficult to get an area of one size large enough to correlate with the soil type.

3. Classes of Farms

Where land is highly productive it is usually found that farms are efficiently run and economically prosperous. That is, the accumulation of capital from profits in good times makes possible good buildings, good herds and the provision of services such as hydro and telephone. There is then a tendency for these farms to be run most efficiently with mechanized equipment, improved herds and use of electricity.

Land of lower inherent capability supports farms which cannot afford the same amenities as the more prosperous farms. Individually they may be capably and efficiently operated, but as a group they do not represent the most efficient and productive form of agriculture.

Farms were rated on a point system which evaluated the fixed factors of production of the farm and the state of production at the time of inspection. The maximum number of points that it was possible for any one farm to obtain was arbitrarily set at two hundred. Of this total, one hundred and fifty or seventy-five per cent were based on fixed factors of production. Only fifty points or twenty-five per cent were based on variable factors of production. Farm buildings, one of the fixed factors of production, were given a maximum of one hundred points or fifty per cent of the total. In essence, this meant that the overwhelming determinant of the farm class was buildings.

Fixed Factors	Factors Considered	Maximum No. of Points
Farm buildings - house, barn, sheds and outbuildings	Size, condition of roof, foundation, etc. Materials used in construction were not considered.	100

Fixed Factors	Factors Considered	Maximum No. of Points
Hydro	Considered only if it was available. Farms in areas where no lines were as yet run were not penalized. The intensity of use was considered.	10
Telephone	Available throughout the watershed	10
Fences	Condition of fences was considered. Good rail fences were not considered as a downgrading factor.	10
Implements	Amount and condition of equipment was considered. Use of horse-drawn equipment on hilly farms was not a downgrading factor.	20

State of Production	Maximum No. of Points
State of crops	20
Quality of herds - beef or dairy	20
Occurrence of weeds	10

Using this system of points, five classes of farms were recognized. They are listed below.

Class	No. of Points		
I	150 plus	-	75%
II	120 - 150	-	60 - 75%
III	100 - 120	-	50 - 60%
IV	less than 100		
AB Farm buildings abandoned			

To produce the accompanying map each farm was visited and assigned to one of the five classes and the symbols plotted on one-inch-to-one-mile topographic sheets. The material was then put together and grouped according to the farm lots as indicated on the county map. In reading the map, if an area is seen which is indicated as Class I it means that more than two-thirds of the area consists of Class I farms. Class II areas include farms more than two-thirds of which are in Class II and so on. Thus the nature of the individual farms is obscured, but the overall pattern of agriculture on the


FARMS
DISTRIBUTION ACCORDING TO CLASS
ON BASIS OF BUILDINGS AND LAYOUT
CLASS I
CLASS 2
CLASS 3
CLASS 4
ABANDONED
SCALE · MILES
1/2 0 1 2 3 4 5
MARKDALE
PRICEVILLE
DURHAM
Gravel Pit
HANOVER

watershed shows up very clearly. The pattern shows a general correlation with the map of physiography. The Glenelg Gravelly Hills show up especially clearly, with a large proportion of abandoned and Class IV farms.

It should be pointed out the classification outlined above is only applicable on the watershed. No comparison was made with any outside area.

Few farms on the watershed are completely abandoned. The land in most cases has been taken up either by lease or purchase by neighbouring farmers who in most cases cultivate a small section and pasture the rest. Farms on which a homestead had been constructed and a start made in farming but which no longer support a family were considered abandoned. In many cases fine brick houses and large substantial barns are found on areas of poor soil such as the Glenelg Gravelly Hills. Sometimes they are abandoned and sometimes they are still occupied and fall into various farm classes. It is difficult to see how farming operations on these soils could have yielded sufficient profits for such construction, for the farms are obviously not in a state of efficient production today.

The farm size and farm classification maps indicate that large areas of the watershed are submarginal from an agricultural point of view. It is evident that a good deal of land requires special management, either as woodland or pasture.

4. Agricultural Regions

When the farm size map, the farm classification map and the map of Present Land Use are compared, it is possible to distinguish several agricultural regions. These regions are by no means clearly defined from one another, nor do they include the whole area of the watershed, but nevertheless the pattern of occupancy and the present condition and use of the land are such that they do show some differences. They are herein described.

(1) The Hanover Region

This region is centred on the Hanover Sandy Plain, with its sandy and gravelly soils. This region has the lowest altitudes of any in the watershed. The light soils are warm and easily cultivated, allowing the farmer to grow a cash crop of wheat and some ensilage corn. The farms in this region are small to medium-sized and fall mainly into Class I and Class III, with some cases of abandonment. There is a high percentage of cultivated land, with only a small acreage devoted to forest and pasture.

Since the soils of this region are light, they deteriorate rapidly unless properly managed. Some adjustment to capability is required here. A change from intensive cropping to grassland management would greatly benefit some of the more seriously depleted soils of the region.

(2) The North Bentinck and Glenelg Region

This region takes in most of the area covered by the Bentinck Whaleback Hills. The main soil type is the Harriston loam, which is characteristic of the drumlins. The farms are again small to medium in size, but fall mainly into Class II and III, although Class I farms do occur.

Adjustment to capability is fairly complete in this region. The drumlins are intensely cultivated where they are not too steep and the steeper slopes and the interdrumlin swamps are left in forest and pasture. Erosion control measures should increase and sustain high yields in this region.

(3) The Edge Hill Region

This region is the most clearly defined on the watershed, since it is a small till plain surrounded on all sides by rougher land. The soils are again Harriston loams and are intensively cultivated. Farms are small to medium in size and are nearly all Class I. Only simple conservation measures combined with ordinary good farming practices are required to sustain a high level of production in this area.

A farm in Glenelg which lacks some mechanical advantages but is kept in fair condition.

This farm in Holland Township has a fair barn and a tractor but is otherwise not as advanced as the better farms on the watershed.

Abandoned farmstead on rocky, hilly land.

Improved pasture is one of the best soil conservation measures which can be carried out on the watershed.

A grassed waterway in a field of grain is good farming practice and good erosion control.

On smooth slopes, alternate strips cultivated "on the level" save soil and water.

(4) The Fardon Lake Region

The predominant soil in this region is of the Pike Lake loam. The region is marked by large farms and an extremely high percentage of abandoned farms. Most of those still operating are third or fourth class. Forest and poor pasture is the predominant land use. Since much of the land in this region is of extremely low capability, it should be acquired by the Authority for the establishment of forest cover or permanent pasture.

(5) The Markdale Region

This region is situated mainly to the east and south of Markdale on the Markdale Rolling Plain. The soil is loamy, but contains more stones and boulders than is usual on a till plain, which tends to limit cultivation slightly. The farms fall either into the small or the large sizes, but all classes of farms are in evidence. The area is mainly cultivated with only small acreages of forest and pasture.

(6) The Dundalk Region

The predominant soil type of this region is the imperfectly drained Listowel silt loam. The farms are medium and small-sized and are mainly Class II and Class III, with some cases of abandonment. The region is mainly cultivated, with only the poorly drained areas remaining in forest, along with small farm woodlots. Tile underdrainage and grassland management is needed in this region to bring the soils up to full productivity.

5. Conclusion

By comparing farm size and farm class with the physiography and land use, it is apparent that a number of factors seriously limit agricultural use. These factors are boulderiness, steep slopes and susceptibility to erosion, light-textured soils and poor drainage. From the regional analysis it is apparent that the good and fair soils carry most of the agricultural production. Conservation calls for the exclusion

of agriculture from soils not suited for it and the management of the better soils in a way which will sustain their fertility.

While the regions described above are not all inclusive, they should be taken into account when conservation practices are being put into effect. They will provide a guide to the overall program of soil conservation on the watershed.

CHAPTER 9

RECOMMENDED LAND USE

1. Basis of Recommendation

The proven capability of the soils is the basis of the recommended land use. Further consideration is given to the present use and the extent of the changes which would have to be made. Once the capability is established, recommendations are made for the special management of certain soils to conform to known principles of soil and water conservation.

The recommended land use for the watershed is shown on the accompanying folded map. This map sums up what is known about the soils of the watershed and provides a guide to future land use. A pattern of land use and management conforming to that of the map should conserve soil and water and make the land serve the whole community to the greatest advantage.

2. Recommended Land Use

Six classes of recommended use account for all of the soil types and conditions. They are:

(a) L - Unrestricted Use

Cultivable land with no restrictions in use, requiring no special management beyond good farming practices, good tillage, fertility maintenance, weed eradication and use of good seed.

(b) CF - Conservation Farming

Cultivable land which requires some special practices to control erosion.

(c) LR - Restricted Use

Cultivable land of lower capability or susceptible to erosion which should be protected by extended crop rotations or which requires intensive soil-building practices (manure, mulch, green manure, etc.).

(d) LD - Drainable Land

Cultivable land which requires artificial drainage to bring production up to its capacity to produce.

(e) P - Pasture

Land unsuitable for cultivation which should be protected from erosion and water loss by the establishment of good sod cover.

(f) F - Woodland

Land of low inherent capability or having excessively steep slopes which should be retained under forest cover or planted with trees.

3. Unrestricted Use

Included in this recommended class are the level and uneroded loams and sandy loams. Regular four- or five-year crop rotations with application of manure and use of artificial fertilizer when necessary should be sufficient to keep these soils in a productive state.

Areas of this class of land are coloured light yellow on the map. That there are no special problems concerning this land does not mean that it is of no concern to the conservationist. It must always be borne in mind that it is only through the best use of the good land that the poorer land will be relieved of the burden which depreciates it.

4. Conservation Farming

This recommended use class, indicated in buff on the map, is land of lower capability which is susceptible to erosion and water loss. It includes the gentler slopes on the Bentinck Whaleback Hills and the Durham, Markdale and Dundalk Plains. The special practices recommended on this type of land are contour tillage, strip-cropping, diversion terraces and grassed waterways, described in the chapter outlining conservation practices.

5. Restricted Use

This is land of lower capability. The soils require building up and can never be expected to give yields consistently as high as those in the previous two recommended

classes. These soils should be protected by the use of extended rotations whereby the land is broken up only once in five years, one crop of grain or intertilled crops grown and then re-seeded to grass or legumes again. Every possible method of rebuilding organic content should be followed, including winter cover crops, green manure, and dressing of stable manure.

This class includes sloping and eroded soils of the Holland Ridge which do not lend themselves to mechanical erosion control and the light-textured soils of the Hanover Sand Plain and the Glenelg Gravelly Hills. The latter soils tend to dry out and the organic content is soon "burned" out of them.

6. Drainable Land

This recommended use type occurs on soils whose capability is lowered by imperfect internal drainage, resulting in late planting and shallow-rooted crops. The capability of these soils may be improved by the installation of tile drains and by the maintenance of a high organic content.

The largest acreage of this type occurs on the Dundalk Silty Plain, with smaller areas in the Bentinck Whale-back Hills. The latter areas can usually be drained with very simple methods of tiling and a low capital outlay. The Dundalk Silty Plain, however, requires much more intensive measures, including the construction of municipal ditches. The soils here are practically all silt loams and may require heavy tiling before they can be properly drained. It is recommended that an experimental drainage area be instituted before any general drainage scheme is undertaken, in order to assess the value of benefits derived.

7. Pasture

This recommended use is indicated on the rougher land of the Holland Ridge and the Glenelg Gravelly Hills which cannot be cultivated economically and which is susceptible to

erosion and water loss and on the steeper flanks of the Bentinck Whaleback Hills. These soils should be protected by seeding to permanent improved pasture. Much of the cleared land in this class is already in use as pasture, but in most cases the quality has deteriorated to a point where it will support only a relatively small number of animals. These areas also suffer from summer drought, indicating a low organic content in the soil. The establishment of a rich, nutritious pasture will be reflected in the production of beef and milk, besides being one of the best conservation practices which can be instituted on the watershed.

8. Woodland

Extensive areas of soils of proven low capability have been designated throughout the watershed for acquisition by the Authority, in order to establish an Authority Forest. These areas are discussed in detail in the Forestry Section of this report. These areas are included, in the main, in the areas designated for reforestation on the map of Recommended Land Use. On this map, however, property boundaries were not taken into account.

Where there are small woodlots and small areas of idle land or poor pasture on the poorest soils, they have been recommended for woodland also. Establishing and maintaining these are, however, a matter for owners and proprietors of land. In some cases, they are adjacent to the bigger blocks recommended for acquisition by the Authority.

It should be understood that existing woodlots on better classes of soils or apart from the areas recommended for woodland should be retained as far as possible. When woodlots are cleared out completely, equal areas of trees should be established on available land of low capability.

RECOMMENDED LAND USE

(ACRES)

Township	Unrestricted Use L	Drainable Land LD	Restrictions on Use LR	Conservation Farming CF	Pasture P	Woodland F	Lakes	Urban	Total
Glenelg	3,089	501	10,583	8,617	8,639	36,948	274	361	69,012
Bentinck	3,380	361	18,136	8,427	6,740	24,531	390	279	62,244
Artemesia	3,982	2,542	10,239	3,295	2,712	14,983	127	165	38,045
Brant	324	-	804	-	44	857	155	144	2,328
Proton	2,903	3,991	2,084	6,342	262	9,488	16	23	25,109
Holland	250	-	3,976	1,155	2,026	6,568	112	41	14,128
Sullivan	-	-	777	321	412	2,387	46	-	3,943
Euphrasia	429	-	2,489	312	822	3,999	29	-	8,080
Osprey	2,085	1,237	798	2,108	184	5,003	-	-	11,415
Melancthon	678	608	-	448	-	940	-	-	2,674
Normanby	68	-	1,307	657	534	1,811	-	-	4,377
Egremont	71	28	2,655	199	2,274	4,924	101	-	10,252
Total	17,259	9,268	53,848	31,881	24,649	112,439	1,250	1,013	251,607
Percentage	6.6	3.6	21	12.3	9.7	44.6	.5		

9. Carrying Out a Soil Conservation Program

Soil conservation falls naturally under three headings - forestry, grassland and farm planning. Good forestry is just as essential in private woodlots as in publicly owned lands. A well managed woodlot provides a source of income and a source of timber and firewood for the farm. Indirect advantages are derived from windbreaks, shady protection of stream sources and habitat for wildlife.

The main features of woodlot management are the exclusion of cattle to allow thick undergrowth and young trees, and cutting of mature, overmature and dead trees. Advice and assistance in matters of woodland management can be obtained from the Zone Forester, Department of Lands and Forests, Owen Sound, Ontario.

The importance of grassland in checking erosion, conserving soil moisture and building soil has already been discussed. Advice on pasture management can be obtained from the County Agricultural Representative at Markdale.

Farm planning means the adoption of a number of special practices especially designed to control soil erosion and water loss and the adjustment of the tillage methods and cropping systems to the capabilities and natural features of the land. The Department of Agriculture has established a division of the Soils Department of the Agricultural College to advise farmers in these methods. This is called the Farm Planning Service. This service is available to the individual farmer who wishes to change his methods of tillage and cropping to conservation farming, by application to the Agricultural Representative.

The establishment of a conservation program depends in the first instance on leadership by the Authority for the individual landowners. Certain large measures such as reforestation and engineering work must, of course, be carried out by the Authority. However, most of the land remains

in private hands, and it is the responsibility of the individual farmers to carry out whatever changes in land use are necessary to ensure soil conservation. The function of the Authority is to demonstrate and teach, and to organize and engage in experimentation where necessary.

In the second instance, the conservation program requires co-operation between individuals. When the land was opened up by pioneers, a great deal was done by community effort which could not be done by individuals alone. Logging bees, barn raisings and threshing bees were essentially community projects. This community spirit is not lost, although the modern mechanized farm is more independent. Many of the measures designed to conserve soil and water can be most economically carried out by community effort.

The community spirit in conservation is best exemplified by co-operation between the inhabitants of a small river valley within the larger watershed. By community effort the costs of establishing a conservation program can be materially reduced. Besides the individual efforts of building grassed waterways, gully control, improved pasture, woodland management, and building farm ponds, the stream itself may be improved by co-operation of the individual farmers. This includes cleaning out the stream bed, planting trees along the banks and fencing the stream from cattle. A complete plan for a small river valley is set out in a booklet entitled the Avon Valley Plan, which is available from the Upper Thames River Conservation Authority.

The most important step in soil improvement and conservation on the watershed as a whole is pasture improvement. The Authority might aid in this matter by the acquisition of land, probably adjacent to an Authority Forest, to be improved and held under sod. Grazing could then be let out to nearby farmers who need extra summer pasture, thus making the project self-supporting. The project would serve two purposes, actual

conservation of the soil on the fields so managed and a demonstration of good pasture management on similar areas.

In the field of farm planning, the setting up of a demonstration on a farm by co-operation of a farmer has proven to be the best method of advancing ideas in a farm community either for a complete farm plan or for showing individual remedies, e.g., improved pasture. This is, however, not so urgent a matter on the Saugeen Watershed, due to the relatively small acreage of land suitable for contour cultivation. A partial demonstration farm might be set up showing the benefits of extended rotations, terraces and winter cover crops.

10. Education and Publicity

It is in the promotion of the ideas and aims of conservation that an Authority can take action at any time. The tools are ready at hand - schools, the local press and radio, agricultural institutes and boards, junior farmers' clubs and farm forums. As these are all local organizations the subject can be dealt with in terms of local conditions. In this way, it is brought home more directly than by books or journals with wide circulation. It is intended that information given in the Land Use Section of the report be helpful in discussion and teaching on a local and regional basis.

11. Conclusion

The map of Recommended Land Use which accompanies this report is an interpretation of the soil resources of the watershed in terms of future use. It is recommended to the Authority and to all those concerned with the welfare of the land as a guide to a land use policy which would conserve the soil resources of the watershed.

FORESTRY

CHAPTER 1

THE FOREST

1. At the Time of Settlement

Good early descriptions of the forests of Southern Ontario are rare, and none have come to light covering the forests of the Saugeen Watershed. However, a fairly good picture may be obtained by piecing together the information which does exist and making observations of the mutilated areas of bush which remain. From these it is possible to see the reasons for the pioneers' animosity to the bush and understand why the ingrained antagonism to trees which developed as a result of the immense toil required in removing them has only begun to disappear in very recent years.

A history of the County of Grey begins with these words:-

> "In the beginning, even before the days of the red men, the picturesque bit of the Western Hemisphere that is now the County of Grey was one stretch of magnificent forest. The elms and maples that delighted the eyes of the earliest explorers covered the hills and valleys, and along the shore the whispering cedars, pine and spruce met the blue waters of the Georgian Bay. Many species of trees and plants, wild flowers and ferns, that are found to the north and south, grew in the limits of this delightful area. Situated between the flora of the northern part of Canada and that of the southern, no spot in the Province had a finer variety of plant life." *

To the early settler these forests offered both advantages and disadvantages, for while they provided fuel and the materials for building a home, at the same time they stood as one of the principal obstacles to the cultivation of the soil; they sheltered the wild animals from which the settler derived an important part of his food supply, and they constituted one of the great hazards of his remote way of life, a barrier between him and his neighbour, an obstacle to every development which he undertook.

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* Marsh. History of the County of Grey. p. 1.

The records kept by the early surveyors contain some information regarding the character of the primeval forests. Part of the instructions issued by the Surveyor General read as follows:

> "Your field book is to be kept in the accompanying form, comprising the kind and quality of the soil and timber, entering each kind of timber in the order of its relative abundance."

In accordance with these instructions, the surveyor's notebooks included a running account of the composition of the forest cover along every line they ran, and thus they provide a reasonably accurate picture of the original "Queen's Bush" in each township surveyed. The following excerpts are taken from the summaries that the surveyors made of their observations on the Garafraxa Road and in the several townships.

<u>Garafraxa Road, Rankin, 1837</u>

"The timber, with the exception of a tract in the neighbourhood of Rapid River *, (where there is some very good pine) is universally hardwood, of the various descriptions, Maple being the predominant.

"To the eastward of the 59th mile† is a good deal of Cedar and Hemlock swamp.

"About the middle of the 52nd mile** is a good large Creek, its shores both above and below the line are flat and lined with Cedar and sometimes with black Alder.

"From this Creek to the Saugin†† the soil is a good brown loam, the timber still hardwood.

"North of the Saugin††, generally a loamy, gravelly soil, hardwood timber.

"From the 38th*** to the 23rd mile†††, hardwood timber, good brown loam and sufficiently supplied with water.

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* The Main Saugeen River, three miles west-northwest of Durham.

† Three miles north-west of Arthur.

** Half a mile north-west of Riverstown.

†† At Mount Forest.

*** The Beatty Saugeen, two miles west of Orchard.

††† In Lot 14, Concession III, west side of Garafraxa Road, in Bentinck Township.

"In the neighborhood of the Rapid * and Fox † rivers there is a good deal of good white pine timber.

"The little lake at the 19th mile ** situated on high land with sloping hardwood shores."

Sullivan Township, Dennis, 1843

"It affords every inducement to Settlers, presenting generally the agreeable features of an undulating surface, good soil (principally clay) , and an excellent quality of timber (Maple, Beech, Elm, Bass, Hemlock and almost invariably the Shrub ground Hemlock)."

Bentinck and Glenelg Townships, Vidal, 1845

"The timber on the dry land is chiefly Hard Maple, Beech, Elm and Basswood, with occasional ridges of Hemlock, and scattered trees of Birch, Cherry and Butternut; there is but very little pine and that of an inferior description, and no oak. In the Cedar swamps which though generally of small extent, are numerous, the cedar, Spruce, Balsam and Tamarac are found in abundance with some Black Ash and swamp Elm."

Egremont and Normanby Townships, Kerr, 1845

"The land is generally heavy timbered land and is well watered. There are a number of small steep hills but none of any great magnitude, between those Hills and generally for some distance on each side of the rivers and streams is swampy and wet, mostly cedar and tamarack with some Pine and Black ash timber grow in those swamps."

Holland and Derby Townships, Rankin, 1846

"Here there is no description of timber fit for transporting, &c."

Osprey Township, Gibson, 1848-1849

"The prevailing timber is Maple, Beech & Elm, on the high land suitable for cultivation,...The timber in the Swamps is chiefly Cedar, Spruce and Tamarack, at the outsides the timber is heavy, and Towards the center it is light and thin unfit for any agricultural purpose. In the thin places the Cranberry is found. Near the outsides, the Huckleberry, Strawberry and black current."

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* The Main Saugeen River, three miles west-northwest of Durham.

† The Rocky Saugeen, one mile south-west of Aberdeen.

** Harrison Lake.

Artemesia Township, Rankin, 1850

"The timber is of the various kinds of hardwood - as Beech, Maple, Elm &c., together with Cedar, Tamarack &c., on the flat lands or swales.

"...covered for the most part with a dense growth of small Balsam, Cedar, Spruce & Tamarack, forming a perfect thicket, and a most forbidding place to attempt to penetrate; from which cause also no doubt so little has hitherto been known of its true character . A large proportion of it however may without much difficulty, tho' perhaps with some extra expense in the clearing &c., be brought into cultivation and prove very good land; the surface is mossy, but the firm clay or sand bottom is not more than a foot average depth below the surface; there are withal scattered throughout this part many larger or smaller tracts of hardwood land of the very best description, and which appear like islands in the thicket.

"The timber universally - except the thicket spoken of at the South end - Beech, Maple, Elm &c."

Egremont Township, Daniell, 1851

"The land in this portion of the Survey is of an inferior quality and is much broken with Swales and wet Cedar and Tamarack Swamps the high land is generally much broken with hills and that which is of a good quality it will be difficult to make Roads to it."

Elderslie Township, McPhillipps, 1851

"The timber - Stunted Hemlock, Balsam, Small Cedars, and Brush, with a few scattered Pines. The timber in the Great Black Ash Swale is also various, viz., Pine, Oak, Cedar, Birch, &c. but Black Ash is the principal. There is no Pine ridge in the Township."

Greenock Township, Walsh, 1851

"...then surveyed the Block enclosed between the 1st Concession North of the Durham Road, and the Northern limit of the 6th Concession, to the Western limit of the Township, being for the most part a Black Ash and Pine Swamp.

"...surveyed the blocks to the Northwesterly limit of the Township, being for the most part a black Ash and Pine Swamp, with lakes thereon,..."

Arran Township, Rankin, 1851

"The timber, the various kinds universally prevailing in this part of the Country, viz, Maple, Elm, Beech &c., on the uplands, with Cedar, Tamarack, Balsam, & Black Ash in the swales or swamps.

"The only place presenting anything like the appearance of a pinery is on lots 28, 29, & 30 of Con B, and the adjoining lots No. 1 in the 11th & 12th Cons., it had to some extent been culled by the Indians during the time they had a saw mill (afterwards burned) at the Mouth of the little stream on lot 28; a great portion of what remains is of an inferior quality."

Saugeen Township, Vidal, 1851

"The Timber of this Township varies in kind and quality according to the soil; on the good uplands Maple, Beech, Elm, and Hemlock are the prevailing kinds, on the flats in addition to these and more numerous are Cedar, Birch, & Basswood, and on the lower levels and wet lands are also Balsam, Black and White Ash and Tamarac. The River and Rivulets have generally a margin of Cedar lining their Banks, but not in large quantity. There is a small quantity of Pine scattered over the 8th, 9th, & 10th Concessions, and in the swamps on the Lake Shore and in the 11th & 12th Concessions a few good sticks of it may be found; on the whole there is but a limited supply of this valuable timber, and the entire absence of Oak, Walnut, White wood & Hickory, with the scarcity of Ash and other timber used for fences will be seriously felt by the settlers. The Hemlock which will have to supply the place of these in some measure is, however, tolerably abundant and of good size and quality, but even this is scarce on the best tracts; an unlimited supply of cedar may be obtained from the Lake Shore for many years, and it is not improbable that to this otherwise useless tract the settlers on the maple lands may have to look for their supply, its lightness and durability making it worth the carriage even to a considerable distance. Though this Township has thus no merchantable timber to export, its woods are of a good description for Potash, and this article will doubtless be produced in large quantity, and, with Hemlock bark for Tanning, will form a considerable export as soon as the lands become settled."

Bruce Township, Miller, 1852

"The Timber, Maple, Beech, Elm, Hemlock, Basswood, a few scattered Oak, and Cedar trees in the Swamp, and a sufficiency of Pine for the purposes of the Township."

Minto Township, Rankin, 1852

"The Timber on the uplands is Beech, Maple, Elm, Hemlock &c., in the Swales or Swamps it is Cedar, Ash, Tamerack, Spruce, Balsam and occasional pines."

Normanby Township, Gibson, 1853

"The Northeast part of Normanby is low, flat land, with considerable Cedar, Spruce, and Tamarack Swamps. The Westerly part of the Township of Normanby is of the best quality of land, timbered with Maple, Beech & Elm, with a clay or gravelly subsoil. Pine timber is found only in the swamps and along the banks of the River Maitland." *

The most striking feature of the Upper Saugeen Watershed from the forestry point of view is the almost complete absence of pine in the original forest, and as one drives over the watershed today, the lack of stump fences is very noticeable. The only area of pine seems to have been in the

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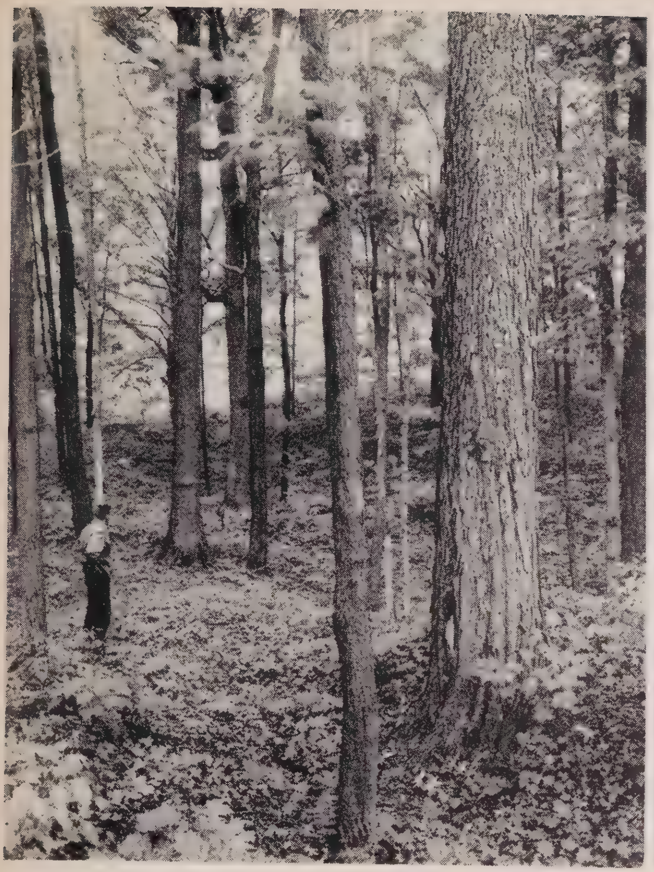
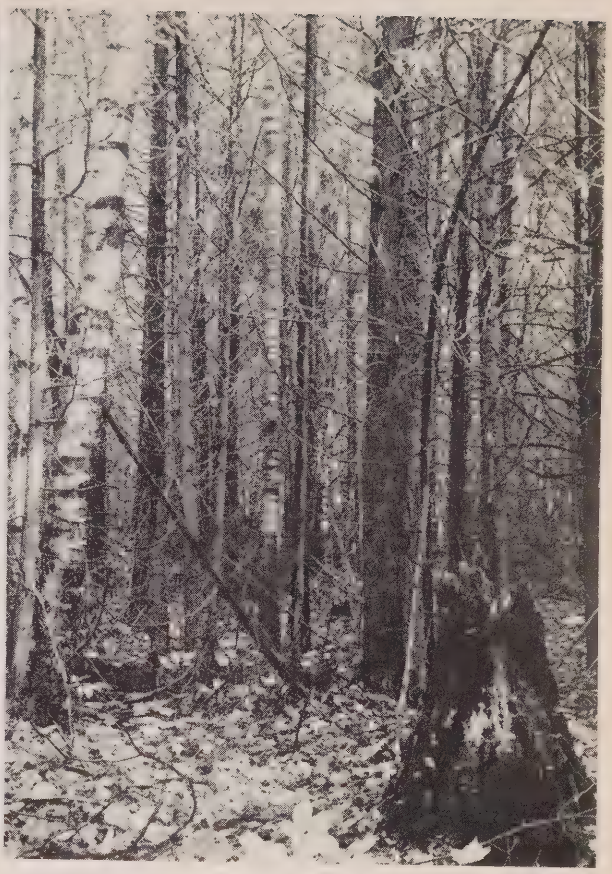
* Erroneously so called, now the South Branch of the Saugeen.



Originally most of the Upper Saugeen Watershed was covered with pure stands of sugar maple. Much of it has been cleared for agriculture, but even today the sugar maple type forms over 25 per cent of the woodland.



Cedar was also very abundant on both dry and wet sites, and this type still constitutes almost another 25 per cent of the remaining woodland.

White pine was always scarce in the Upper Saugeen Watershed, the only stand of any extent being that north of Durham mentioned by Rankin in 1837, which may have extended to Wilder Lake where a few trees may still be seen.

vicinity of Durham. Rankin noted the north end of this area in 1837, and it probably extended south-east to Wilder Lake. Apart from this there were no stands of pine of any size, though scattered trees occurred among the hardwoods throughout the watershed.

The forest was primarily a sugar maple forest over most of the dry land, while the swamps produced an unusual quantity of cedar, which helped to compensate for the shortage of pine.

2. Since Settlement

The attitude of the early settlers to the forest was completely hostile, as has been shown, which feeling was very natural because the forest was undoubtedly the greatest obstacle to the economic development of the land. This ingrained antagonism became a sort of vendetta which has only begun to disappear in comparatively recent years.

When a new area was opened for settlement the best land was naturally taken first and the rough and swampy areas were avoided. Land was usually cleared first along the fronts of the farms and the woodland cut farther and farther back toward the end of the farm which lay farthest from the road. This was done, in many cases, without reference to the quality of the soil except where it was swampy.

The land bordering the swamps was eventually taken up, the swamps were partially drained so that the edges became dry enough for partial cultivation, and the forest was pushed back so that today the centres of the swamps form the nuclei of many of the larger patches of woodland in the Saugeen Watershed. These swamps also form the largest natural surface water-storage areas, and in many cases are the sources of head-water streams. Trees will grow here in most cases and are probably the most profitable crop which can be raised, especially since they perform the additional function of protecting the

source areas from too rapid run-off.

Although settlement did not begin until about 1850, the census records show that in Grey County occupied farm land was 54 per cent cleared by 1870 and 79 per cent cleared by 1900. In 1940 woodland is given as about 17 per cent of occupied farm land.

The accompanying table shows the rate at which the forests were cut rather than the actual areas of woodland remaining at the dates shown, because the definition of woodland varies with the individual person. For instance, a farmer may consider cut-over land which is used as pasture to be pasture, while the forester may consider similar cut-over land, on which the reproduction is good, as potential woodland and records it as such. The actual measurement of woodland in the Upper Saugeen Watershed made in 1951 shows a total of 54,705 acres or 21.3 per cent.

CHAPTER 2

FOREST PRODUCTS

Because the forests of the Saugeen Watershed were predominantly hardwood and settlement came later than in the counties farther east, the pattern of history of the forest products is somewhat different from that of other parts of Ontario.

All the timber taken out for export had to travel first westward down the Saugeen and then eastward through the Great Lakes to reach the seaport; consequently comparatively little of it was exported to Britain though large quantities went to the United States. Softwood timber was never abundant and most of it was required for local use.

1. Early Policy

Previous to 1826 the only persons authorized to cut timber on the public lands were the contractors for the Royal Navy, or those holding licences from them, and there was great infringement of the regulations and much illicit trade. But in this year the first steps toward making the forest resources a source of revenue to the Province and "so securing to the public a share of the wealth drawn from the public domain" led to co-operation among the officials and the termination of the contractor's monopoly. The inauguration of a system under which anyone was at liberty to cut timber on the ungranted lands of the Ottawa lumber region on payment of a fixed scale of rates to the Crown overcame in large part the annoyance of the people and authorities in the colony against the export of the sound Canadian timber for the British navy.

2. Masting

The selection of mast timber was made by government agents who went through the forest blazing with a broad arrow - the mark of the British Government. As late as 1827,

when Peter Robinson was appointed Surveyor-General of His Majesty's woods and forests in the province of Upper Canada, he was instructed "to make a survey of the districts where there may be any considerable growth of masting and other timber fit for the use of His Majesty's navy".

The mast and spar export to Britain was thriving in the thirties and forties and it was continued intermittently as late as 1855. The British trade dropped off noticeably after 1854 and this may be attributed to the Reciprocity Treaty with the United States in that year, "securing the free exchange of the natural products between Canada and the United States, including timber and lumber of all kinds, round, hewed, and sawed, manufactured in whole or in part", and the building of railway connections with the United States border cities.

3. Square Timber

The square timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties.

Square timber was obtained by selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge", but later, when the best timber had been cut, they were squared with a rounded shoulder or "wane", and were known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

> "Often only one tree in a thousand would yield a finished 'stick' (so was the heavy square timber nonchalantly called in the trade) fit for export. A good stand might yield thirty or forty trees an acre for over the whole area allowances had to be made for 'wants' - the non-bearing patches of swamp, burn, etc. Today a whole township or limit (in Northern Ontario) may not have one good square stick of the quality of the square timber of another day."*

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* A Hundred Years A-Fellin', 1842 - 1942. Gillies Bros. Ltd. 1942.

The timbers were transported by the river, by teams or by railway to the lake and were built into huge rafts on which the lumberjacks built shanties and lived during the trip down to the timber coves at Quebec.

4. Saw Material

From 1800 on the cutting of timber had been one of the most important domestic businesses in most parts of Southern Ontario, and a very considerable business was carried on.

In order to convert logs into boards the first method used was pit-sawing. This was sometimes done on the bank of the river, as such procedure saved the necessity of digging a pit.

The more usual methods of pit-sawing appear to have been the digging of a pit or building of a platform with a simple but firm and strongly constructed framework. In either case the framework was made the right height for one man to stand underneath, while the other man stood above on the platform or astride the log. This hard method of sawing timber was laborious, and twenty-five boards were a heavy day's work for two men; the boards were nearly always one inch thick, with planks two inches, and the occasional flooring one and a half inches in thickness.

The first power saws were a direct development of the manually operated pit saw. These were called frame, upright or muley saws and consisted of a saw set vertically in a wooden frame and moved up and down by means of a crank connected to the shaft of the water wheel.

> "Wherever a settlement is formed in America a sawmill is very soon after, if not at the same time, erected. The number of sawmills in the British colonies are inconceivable to those who are not familiarized to the rising settlements of new countries.
>
> "A sawmill is in fact a most important establishment. It not only forms a nucleus or centre to a settlement, but a first-rate sawmill, with two frames, will give employment to four first-rate, four second-rate and two third-rate sawyers, besides a measurer, a blacksmith and from thirty to forty men to prepare the

> timber required and for other requisite work connected with the establishment; twenty oxen and two horses are also necessary for hauling the timber required to streams and to other places. The boards, deals and scantlings sawed at these mills, excepting such as are required for the use of the neighbouring settlers, are rafted down the river for shipping. As fresh waters change the colour of the deals from their fresh whiteness to a dark gray and, in the eyes of prejudice, depreciate their value, it becomes an object, but one that can only be attended to occasionally to carry them down in bateaux, scows or on timber rafts."*

A study of the Census of Canada returns of forest products of farms for the counties of the watershed given in the table reveals the various trends and changes in the lumber industry fairly clearly.

From 1870 to 1890 much of the timber was squared and measured in cubic feet. In 1870 other products listed were firewood, staves, lathwood, tanbark, and masts and spars. Between 1880 and 1890 the peak production of nearly all items was reached and squared elm alone in Grey County ran to over 600,000 cubic feet in 1880. In 1890 fence posts and telephone poles were added to the list of products, as were railway ties. In the census years of 1900 and 1910 square timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars and tanbark disappeared from the records after 1910.

In 1920 no square timber is shown, logs are only counted, not measured, and not even separated by species. The returns of the latest census covering the year 1940 name only one forest product and the rest are all listed together as others valued at so many dollars. The one product which has persisted throughout the records is firewood which in Grey County has dropped from a peak of 268,818 cords in 1880 to 87,553 cords in 1940.

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* John McGregor, 1833. British America, Vol. II.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed regularly until 1890, after which it no longer appears due to the depredations of the larch saw-fly which almost wiped it out at this time. The returns show that some black walnut and hickory were cut in 1880. White pine was, of course, the species most sought after, though not much existed in Grey County, and next to it red pine of which a little was present. In 1870, 1880 and 1890 elm was the main species which was squared, but as these species became scarce more ash, birch, and maple were made into square timber.

5. Shingle-Making

In the history of roofing used on the Saugeen Watershed it is found that the first covering for human habitation on the river was the Indian elm-bark lashed roof. The first type of roof used by the early settlers was made of "scoops" which were flattened logs, usually cedar, six inches thick with one face scooped out to a depth of one to one and a half inches. These ran from the peak of the roof to the eaves, being placed alternately so that one scoop had the scoop side up and the next one the scoop side down, the edges overlapping the two scoops below.

The second type of covering was a rude type of shingle called a "shake". These were made with an axe or frow and were cut from pine or cedar three or more feet in length. Although not shaped they were a great improvement over the early types of covering.

Very early in the history of settlement, however, hand-made shingles were introduced. The shingle-maker would saw the logs into short lengths or bolts and split them with a frow to the right thickness. The shingle was then fastened by one end in a device called a shingle horse and by means of a heavy drawknife the shingle was tapered to an edge. This method was

rapid and it has been said that a good shingle-maker would turn out from eighty to a hundred of these hand-made shingles an hour.

Up to the seventies and even later the shingle-maker continued to use drawknife and frow, but gradually in the seventies the generation of craftsmen died out and the shingle mill, where shingles were sawn, became the general source of supply.

6. Fuel and Ties

From the earliest days of settlement on the Saugeen to 1850, wood was the sole source of fuel supply. All species were used for this purpose including beech and maple - although these were furniture woods as well. In 1890 nearly 400,000 cubic feet of squared maple with a little birch was produced. With the inception of the railway and steam-driven factories, the forests of the area were ruthlessly cut to feed industry.

In the very early days of the steamship, 1832, the Honourable Adam Fergusson writes:

> "Wood is furnished upon the St. Lawrence for one dollar, or five shillings per cord while upon the Hudson it now costs three times as much. - A man may prepare two cords a day, but it is severe work, and the price, which is one dollar per cord, will do little more than compensate maintenance and labour - and an ordinary steamboat consumes fifty or sixty cords or about 7,000 cubic feet each trip (from Montreal to Quebec)".

The price of cordwood in 1825 was quoted at $2 a cord.

With the coming of the Waterloo, Grey, Bruce Railway locomotive requirements took large quantities of the best body hardwood, chiefly beech and maple.

> "Coal at that time was not to be had and the result was that hardwood was gradually becoming of some value. For cordwood the settlers usually realized from $2.50 up to $3.00 per cord, delivered at the various stations along the railway line. Railway facilities also stimulated the lumber industry."*

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* Waterloo County Forests and Primitive Economics. E. W. B. Snider. 6th Annual Report of the Waterloo Historical Society, 1918.

FOREST PRODUCTS OF FARMS - CENSUS OF CANADA FIGURES - GREY COUNTY

Product	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940
Pulpwood		Cord			464	235	304	707	178	412
Tanbark		"	960	1,187	3,485	1,260	206			
Lathwood		"	55	395	192					
Masts & Spars		Number	60	351	477	1	4			
Staves		M	543	559	986					
Fence Rails		Number						11,950	11,018	
Fence Posts		"			254,681	53,728	26,587	29,729	19,060	
Poles		"			34,785	3,085	5,988	1,379	1,901	
Rwy. Ties		"			215,934	33,286	23,759	18,136	6,716	
Sq. Timber	White Pine	Cu. Ft.	96,226	46,836	111,585	6,271	5,458			
	Red Pine	"	14,593	5,065	115					
	Ash	"				25,179	640			
	Oak	"	1,954	8,002	4,917	480				
	Tamarack	"	9,303	160,301	20,490					
	Birch/Maple	"	2,300	8,247	395,923	42,104	120,962			
	Elm	"	126,692	601,247	394,303	286,204	33,142			
	Walnut	"		900						
	Butternut	"	126	1,525	10,000					
	Hickory	"		2,350						
	Other	"	198,779	1,326,792	148,177	45,233	40,572			
	Total	"	449,973	2,161,265	1,085,510					
Logs, Softwood	Pine	Number	13,912	110,040	195,199	376M	258M			
	Hemlock	"				5,535M	1,704M			
	Hickory	"				11M	12M			
	Oak	"				130M	43M			
	Spruce	"				384M	394M			
	Elm	"				5,892M	3,230M			
	Others	"	71,586	401,266	588,764	16,153M	15,592M	189,648M	2,722M	
Firewood		Cord	186,935	268,818	246,340	226,305	140,804	147,851	129,533	87,553
Shingles		M			23,862					
Other Products		Value $						4,462	6,240	92,271

(M = 1,000 feet board measure)

7. Road Materials and Fencing

In the early days the making of corduroy roads furnished another important wood use. The Indian trails had followed the ridges and natural conformation of the country, but when the "T-square" roads had been laid out in government offices they followed the arbitrary lot and concession lines regardless of natural contours. Many of these roads were built through swamps and in these places corduroy construction was used. Many corduroy bridges and culverts were also placed over the river and its tributary streams.

The building of plank roads - a form of highway in which the planks were laid crosswise and side by side - was done in several parts of the Province. Plank roads alternating with gravel stretches connected the main centres. Due to the abundance of gravel in the Saugeen Watershed it is doubtful if many miles of road were planked but constracts were let for construction specifying that roads were to be planked, gravelled or Macadamized.

Much wood was also used for fencing and for this cedar from the swamps was most common. The troublesome pine stump also was used for this purpose in many parts of the Province, although in very early times it seems that it was left in the field. Around 1900 the wire fence came into use generally and thereafter a fence post industry was developed. These were cut as a rule to a standard length of eight feet, while the diameter varied greatly.

8. Woodworking and Planing Mills

The extensive hardwood forests which formerly existed over the greater part of the region were the reason for the large number of wood-using industries which were established, many of which are still doing a big trade although much of their raw material is now imported.

During the early years of settlement in the rural districts and communities, house trim for exterior and interior

use was made by the same man who constructed the frame of the house. The custom up to the fifties at least was for the carpenter to board with the family the winter before the new frame house was to be built and work all his timber into shape by hand, both for exterior and interior use.

The early carpenter also made door and window frames and all interior trim of the house by hand and for all these products pine was the usual type of timber chosen. It would seem that doorsteps were one of the very few things for which oak was used in house building, at least up to the sixties.

Generally, as time passed, the building trades became more differentiated and more craftsmen settled on the watershed.

After the appearance of the planing mill in the fifties the end of the hand-made door and window frame was foreshadowed and much of the general carpenter's work was taken over by mill or factory. By the 1860's the planing mill business was well under way.

9. Wooden Implements and Vehicles

(a) Early Tools

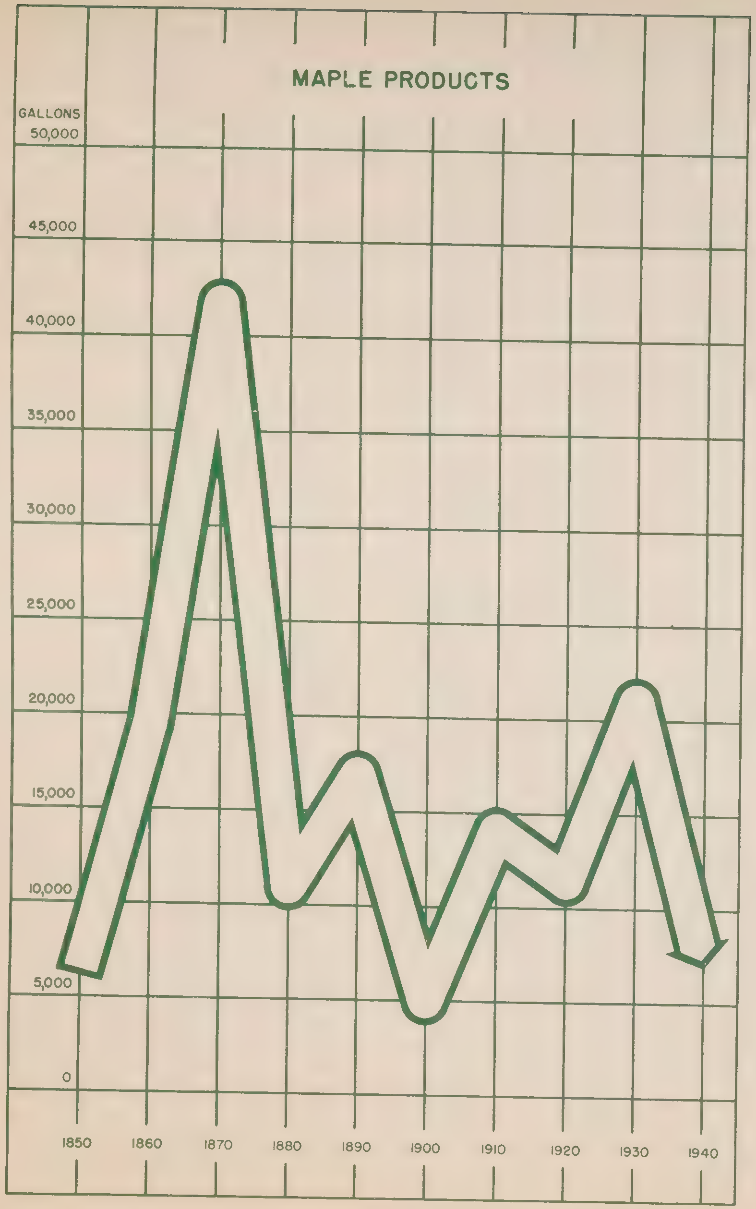
From the very early days hickory was preferred for the making of axe-helves or handles, while for beams or ox-yokes beech was used extensively and, for the loop, ironwood would have been selected. Spike handles were made of rock elm, white ash, hickory or ironwood; the beetle-head (a mallet used for pounding hemp and flax) was also made of ash, elm, hickory or ironwood. The hardwoods growing on the watershed were used almost entirely for making handles of implements, whereas pine was preferred for all building operations when it could be obtained.

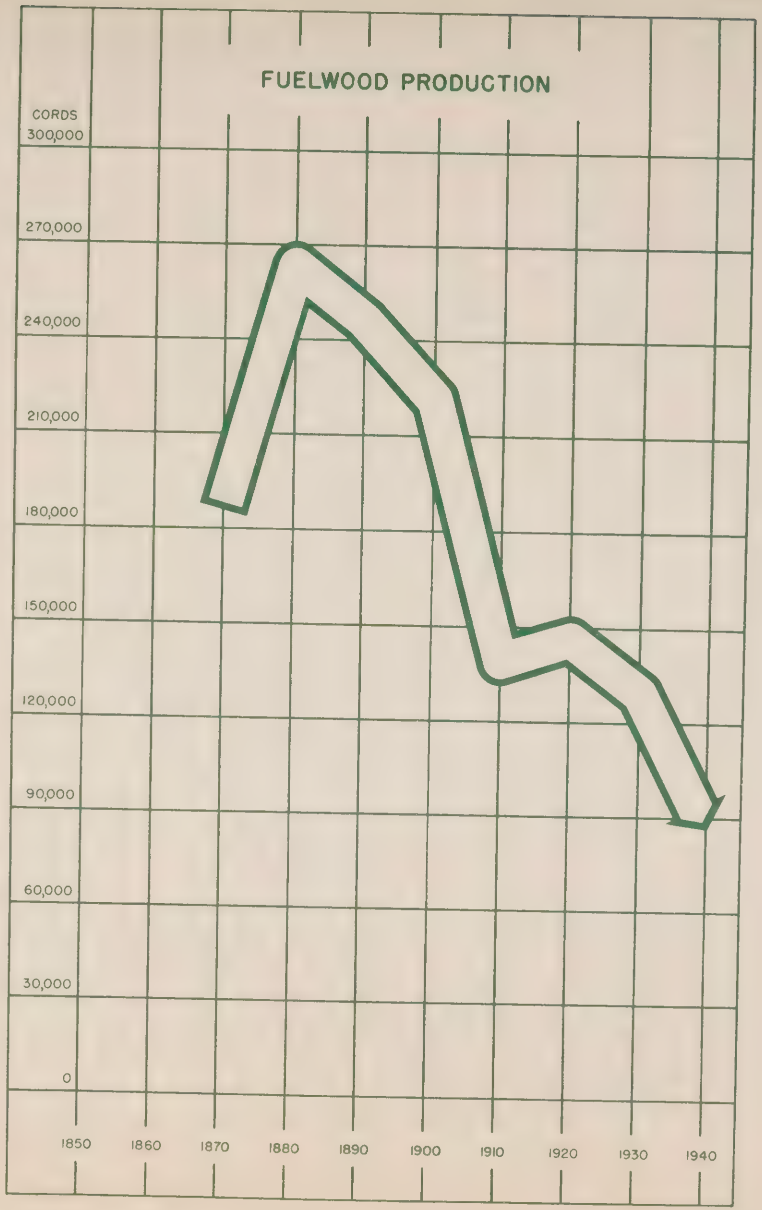
(b) Vehicles

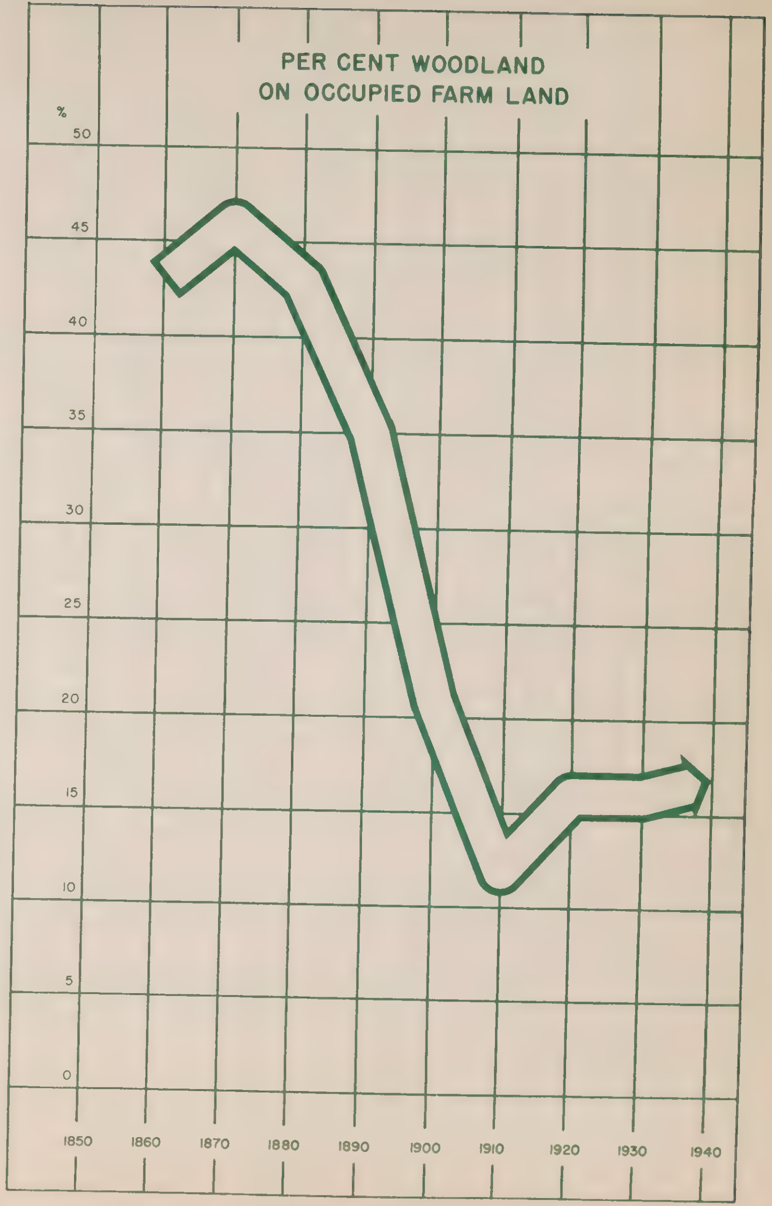
From early times the making of vehicles progressed as carts, wagons, sleighs and hay and wood racks were built by the farmers. In the building of carts and wagons, whiffletrees, wagon-tongues and binding poles were made of rock elm, white ash,

GREY COUNTY

CENSUS OF CANADA FIGURES







hickory and ironwood, as were also sleigh-runners and hay and wood racks. Usually the wheels or runners of these conveyances were bound with iron, although the use of metal was limited in early days since the supply had to be imported by water.

10. Indirect Products and By-Products

The three indirect products of greatest importance were potash, maple sugar and tanbark. Maple sugar furnished the staple sugar for the pioneers, cane sugar not having been procurable at that time; lye or potash was used domestically in making soft soap - almost the universal soap; tanbark was utilized by the shoemakers in dressing leather.

(a) Potash

The ashery played an important role in the drama of pioneering life; and besides communal asheries the individual ash house and the ash barrel on a platform for leaching was a characteristic of each farm in the days before the soap factory.

> "Only from the sale of potash (exported to Great Britain and the United States for the dyeing of textiles) was there money for all other requisites. The potash was laboriously produced, men, women and children sharing in the heavy work. No less than 60 large maple trees were required for a barrel of 650 to 700 pounds of potash. The ashes of the burnt wood were leached in wedge-shaped wooden troughs and this liquid was then boiled down and cooled in huge vessels or coolers where the lye solidified. Two coolers would fill a barrel. If the settler marketed this on his own, 'toting it out' to the nearest buyer for ready cash, he might get only $8.50 to $9.00, but if he could wait and accept a down payment from the traders and shippers who teamed and hauled at a season of their own convenience, he might get $10 or $12 with a possible second payment after marketing it at Montreal where a barrel might bring $30, less of course commission, risk and portage costs. The need for this pitifully hard-won money led to clearing of more land than could be cropped and not infrequently to concealing for years the fact that the holding itself might not be profitable or capable of sustaining the settlers from the growth of its poor soil."*

(b) Maple Sugar

The table shows the Census figures for maple

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* A Hundred Years A-Fellin', 1842 - 1942. Gillies Bros. Ltd. 1942.

GREY COUNTY

CENSUS OF CANADA FIGURES

MAPLE PRODUCTS

1850	1860	1870	1880	1890	1900	1910		1920		1930		1940	
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.
56,797	194,117	417,762	110,427	167,567	51,078	741	13,917	58	11,443	119	20,996	2,128	6,843
Gals.	Gals.	Gals.	Gals.	Gals.	Gals.		Gals.		Gals.		Gals.		Gals.
5,680	19,412	41,776	11,043	16,757	5,108		13,991		11,449		21,008		7,056

In the second table pounds of sugar have been converted to their equivalents in gallons of syrup for purposes of comparison

WOODLAND ON OCCUPIED FARM LAND

1 1850	1860	1870	1880	1890	1900	1910	1920	1930	1940
Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
186,820	451,812	480,650	455,578	367,704	220,228	127,114	164,123	169,872	179,277

products in Grey County. It is interesting to note that up to 1910 production is all recorded as pounds of sugar; from 1910 on both pounds of sugar and gallons of syrup were shown, indicating the change from a pioneer necessity to the modern luxury. For purposes of comparison the sugar figures have been converted to their syrup equivalents and from these shown in the second table it will be seen that production for Grey County dropped from the peak of 42,000 gallons in 1860 to 7,056 in 1940. The production has, however, been maintained much better than in other counties, partly because of the abundance of maple trees and the preservation of the woodlands.

Wood-using industries of the present time are given in Chapter 10 and there is no reason why, with optimum land use, a good deal of the timber required to support these industries cannot be grown within the watershed in perpetuity, using land which is unsuited to agriculture and land which requires woodland cover for natural water storage and run-off control with the consequent advantages to both urban and rural communities.

CHAPTER 3

PRESENT WOODLAND CONDITIONS

The entire Upper Saugeen Watershed lies within the Huron-Ontario Section of the Great Lakes—St. Lawrence Forest Region *. In this forest section, as a whole, the prevailing association of forest trees is dominated by sugar maple and beech and this association is described as the climax type for the area. This climax type has other species occurring which are termed its associates. On local or specialized sites such as river bottoms and swamps there occur other aggregations of trees which may bear no relation to the typical or climax forest of the area, for example, an association where balsam fir is the dominant species. These distinctive local combinations of tree species are in response to very local climatic, soil, topographic and drainage features. It is not usually possible to determine the specific influence of these natural features with respect to the species occurring in any piece of woodland but certain broad patterns and relationships are observable throughout the area as a whole.

The area is characterized by a diversity of topographical features† such as hills, plains, and deep broad

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* Halliday, W. E. D. Forest Classification for Canada. 1937.

† The regional divisions of the area are described in detail elsewhere in this report. The various regions distinguished for the area are listed with their physiographic terminology opposite.

	Landscape Type	Physiographic Name
1.	Holland Ridge	Singhampton Moraine
2.	Hanover Sandy Plain	Broad Saugeen Terraces
3.	Bentinck Whaleback Hills	Drumlinized Till Plain
4.	Durham Rolling Plain	Durham Till Plain
5.	Glenelg Gravelly Hills	Saugeen Kames
6.	Markdale Rolling Plain	Markdale Till Plain
7.	Dundalk Silty Plain	Dundalk Plain
8.	Swampy Saugeen Flats	Saugeen Spillway

valleys. The more adequately drained hills and rolling plains are typically clothed with a mantle of broad-leaved or deciduous trees of which maple is the most characteristic. The beech often occurs but in this very local area of the Huron-Ontario Forest Section pure sugar maple, rather than beech and sugar maple, is the climax type. The woodlands of the poorly drained valley floors and flat plains are dominated by mixtures of swamp hardwoods and conifers frequently intermingled with areas of pure conifers or hardwoods. White cedar, balsam fir and tamarack are the chief coniferous species in these sites, whereas black ash, white elm and poplar are the principal swamp hardwoods .

The characteristics and potential of the present woodland of the area are well illustrated when the total forest area is mapped by a system which separates areas which are of different species composition and groups from those which have similar compositions. This was the method of forest cover typing used to provide the picture of woodlands in the Upper Saugeen Watershed.

1. Survey Methods

Basic to any work program for woodlands, an inventory of present conditions is required. The bulk of the summer work time of the Forestry Section was directed toward collecting such data.

Each member of the Forestry party was provided with aerial photographs which were on a scale of approximately 1,000 feet to the inch, each photograph covering an area of about 1,000 acres, usually a block lying between two adjacent concession roads and two adjacent side roads. Mapping was done in the field directly on the photographs.

Every area of woodland, brushland, marsh, swamp and rough land was visited and notes made describing it. In the case of woodlots and plantations, detailed notes were made of their condition. Woodlots with very scattered trees and over-

grazed woodlots which could be restored were classified as woodland, as were second-growth swamps which are termed wasteland for assessment purposes. In short, where doubt existed as to whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

Field parties were directed to map on their aerial photographs all streams and emission points of springs in both open and wooded land in so far as a reasonable expenditure of time would permit. No attempt was made to distinguish in the field or on the final maps between permanent and intermittent springs and streams, this being the field of the specialists in biology on the stream condition survey being conducted by the Wildlife Section of the Conservation Branch.

All woodlots were grouped according to the following classification:

Diameter Breast High	Hardwood	Mixed Wood	Coniferous
Virgin	H-1	M-1	C-1
Over 18 Inches	H-2	M-2	C-2
10 to 18 Inches	H-3	M-3	C-3
4 to 10 Inches	H-4	M-4	C-4
Under 4 Inches	H-5	M-5	C-5

In this classification and elsewhere in this report the term "hardwood" is used to denote all broad-leaved trees irrespective of whether the wood is physically hard or not. This practice is followed by large firms which handle both hardwood and softwood and by forestry authorities. At the smaller sawmills and lumber yards and among farmers it is a common technical misnomer to classify such hardwoods as poplar and basswood as softwoods because their wood is soft in comparison with other woods such as maple and beech. The term "softwood" is used throughout in reference only to coniferous species such as spruce, pine and hemlock. A hardwood type is one in which 80 per cent or more of the stand is composed of hardwood

trees, a coniferous type is one in which 80 per cent of the stand is composed of coniferous trees and a mixed stand embraces all others. All diameter ranges were determined in the field by ocular estimation.

Stands were also grouped according to forest cover types. See table, the description of forest cover types, and the map in the section which follows. This map shows only a small portion of the total area surveyed and is included to show the manner in which some of the basic inventory data from the survey may be mapped. Large-scale maps showing all the existing woodland of the watershed by cover types and diameter ranges are available to those members of the Authority, Lands and Forests and others who may have a genuine interest in these data.

Where plantations were encountered records were made of planting, care, damage and survival.

Areas of woodlands in acres were determined by the dot-planimeter-grid system applied to the aerial photographs. This system is entirely satisfactory and errors may compensate over an extensive area if the land units measured are equally distributed in ground elevation on either side of the elevation taken as the mean of the region for aerial photography purposes. However, this convenient pattern rarely exists and so areas interpreted from photographs in this way may be in error. Throughout this section on present forest cover and conditions no adjustment for this probable area error has been made.

2. <u>Forest Cover Types</u>

In making the survey of the woodlots no attempt has been made to classify them according to forest types. Forest cover types only have been used and a forest cover type is defined as being* "a forest type now occupying the ground - no implication being conveyed as to whether it is temporary or permanent".

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* Forest Cover Types of the Eastern United States - Report of the Committee on Forest Types, Society of American Foresters, 1940.

A forest cover type may be either temporary or permanent; for example, the present stand may be aspen which has seeded in the area following fire. Aspen seed is light like dandelion seed and is carried easily by the wind, thus it quickly covers large areas. Also it is not exacting in its soil requirements and may be the only species which will grow under the soil conditions existing at the time. The fact of its growing and dropping its leaves on the ground gradually improves the condition of the soil so that more exacting species can grow. In addition its light shade frequently provides the correct light conditions for better species to get a start. As it is a short-lived tree it will die early and the other species will dominate the area. This succession may be carried through two or more stages until the species best suited to the area or best able to maintain itself on the area takes over. This is called the forest type or climax type, as distinguished from the forest cover type which is the type occupying the ground at the present time. The most common forest type on the Upper Saugeen Watershed is sugar maple.

No classification of forest cover types has been made in Canada for Southern Ontario so the system used is a slightly modified form of that drawn up by the Society of American Foresters. Their classification covers the whole of the Eastern United States, and consequently there are many types in it which do not enter Canada. This accounts for the gaps in the numerical listing of types occurring in the Upper Saugeen Watershed.

The forest cover types mapped in the Upper Saugeen Watershed are listed. Species which appear in the type name form a predominant part (50 per cent or more) of the composition of the stand so classed.

Type Number	Name
4	Aspen
5	Pin cherry
6	Paper birch
10	White pine - hemlock

Township	No. of Woodlots	No. of Acres	4	5	6	10	11	12	13	14	14a	15	21	22	23	24	25	26	57	59	60	60a	88
Artemesia	719	7,015	1,489	5	32		3	71	38	1,290	12	16	70	556		1,548	66	755	609	2	122	331	
Bentinck	1,357	11,879	322	4	24		121	10	295	3,201	39		7	112		3,067	324	2,404	827	47	134	626	8
Brant	57	253	11				3	67	8							57	32	12	35			7	21
Egremont	263	2,225	64		1	8		36	18	696	6			29		804	21	109	319	2	61	51	
Euphrasia	150	1,805	37							925				8		277	19	165	328		4	42	
Glenelg	1,708	17,324	599		5		44	111	350	5,624	47	13	2	536	17	4,850	199	1,807	2,625	2	209	777	7
Holland	334	3,295	291	3	11		28	36	48	1,108				60		493	88	341	694		14	80	
Melancthon	50	428	199					7		20				8		100		5	4		2	83	
Normanby	136	865	39				23	37	34	142	2			61		184	5	242	61	4	1	30	
Osprey	162	2,549	1,357		41			7		196			65	302		289	6	39	117			130	
Proton	468	5,526	1,799		29		29			457	6		34	228		1,615	133	340	650		56	150	
Sullivan	114	1,041	128		1				28	328	7			9		157	11	184	158		9	21	
Total	5,518	54,705	6,335	12	144	8	251	382	819	13,987	119	29	178	1,909	17	13,441	904	6,403	6,427	57	612	2,328	36
Per Cent		100.0	11.6	0.1	0.3	0.1	0.5	0.7	1.5	25.7	0.2	0.1	0.3	3.5	0.1	24.6	1.6	11.7	11.8	0.1	1.1	4.3	0.1
Rank by Area Occupied			5	20	14	21	12	11	9	1	15	18	13	7	19	2	8	4	3	16	10	6	17

Type Number	Name
11	Hemlock
12	Sugar maple - beech - yellow birch
13	Sugar maple - basswood
14	Sugar maple
14A	Black cherry
15	Yellow birch
21	White spruce - balsam fir - paper (birch
22	Balsam fir
23	Black spruce
24	White cedar
25	Tamarack
26	Black ash - white elm - red maple
57	Beech - sugar maple
59	Ash - hickory
60	Silver maple - white elm
60A	White elm
88	Willow

Type 4 Aspen

Aspen is a pioneer type coming in after clear-cut operations, overgrazing or fire. It quite frequently is the invasion species on abandoned fields and pastures. Though it avoids the wettest swamps it does grow on soils that are wet throughout a good part of the year, and occurs as well on the droughty soils. Its associates may be large-toothed aspen, balsam poplar, red cherry, white elm and paper birch. An understory of dogwood or of spruce and balsam fir on the wet sites, or of tolerant hardwoods on the drier sites, is frequently present. In the Upper Saugeen Watershed it occurs in greater area in its wet-site phase rather than its dry-site phase and forms a large percentage of the swamp cover in the Dundalk plain region of Proton, Osprey, Artemesia and Melancthon Townships. It forms about 12 per cent of the woodland of the watershed.

Type 5 Pin Cherry

Pin cherry, like aspen, is also a short-lived pioneer type occurring on well drained poor to good soils on heavily cut or burned areas or abandoned fields and pastures. It may be succeeded by aspen or other hardwood. It occurs only as very small fringe or opening patches closely associated with other hardwood cover. Only 12 acres were mapped.

Type 6 Paper Birch

This is a pioneer type of clear-cut, burn or pastured areas succeeded by other northern hardwood or spruce-fir types. Its associates are small proportions of trembling aspen, balsam poplar, yellow birch and hemlock. It occurs mostly as isolated patches on the edges of cedar and poplar swamps, mainly in Osprey, Proton and Artemesia Townships. Only 144 acres were mapped, being less than ½ of one per cent of the total woodland of the watershed.

Type 10 White Pine - Hemlock

Associated with this type are many species but none is particularly characteristic. The principal ones are sugar maple, basswood, beech, paper birch, yellow birch, black cherry and white ash. It may occur on a wide range of sites from sand plains to heavy upland soils but favours cool locations. It was mapped only in the Wilder Lake area of Egremont Township where the eight acres which occur are all that remains of a cover type which formerly was more extensive in that vicinity.

Type 11 Hemlock

This type occurs in widely scattered bodies in cool locations, moist ravines and north slopes, frequently in the sugar maple - beech type or as coves on the fringe of white cedar and balsam fir types. Its associates are sugar maple, basswood, beech, yellow birch, black cherry, white ash, paper birch, balsam fir and white cedar. It is found chiefly in Bentinck and Glenelg Townships and makes up ½ of one per cent of the remaining woodland in the Upper Saugeen Valley.

Type 12 Sugar Maple - Beech - Yellow Birch

The associates of this type are basswood, hemlock, balsam fir, white cedar, black ash, white elm, paper birch and black cherry. The percentage of yellow birch present is relatively low and the tree is of general poor quality. Though it is a common type of farther north it is rather insignificant as a cover type in the Upper Saugeen Watershed which is near the

southern range (latitude and altitude) of yellow birch. The type in this area typically may be considered to be the common sugar maple - beech association in sites of generous moisture conditions. Just under 1 per cent of the total woodland area was classed as this type.

Type 13 Sugar Maple - Basswood

This is a fairly important type commercially since the species that occur are of good quality, probably because the type occupies rich upland soils. Its associates are white ash, butternut, black cherry, white elm, with ironwood as a prominent subordinate. The number of basswood stems per acre is probably greater now than in the original forest cover of the area because of logging and the strong suckering habit and rapid growth rate of the species. This type now comprises 1½ per cent of the woodland.

Type 14 Sugar Maple

This type and the closely related Type 57 (Beech - Sugar Maple) originally covered most of the upland or better drained areas of the watershed, but since it occupied land which was considered fertile and with good moisture conditions much of it was cleared to make way for agriculture.

Calcareous soils are considered desirable for the vigorous growth of high-quality hard maple timber, and the upland soils of the area seem to satisfy this requirement well. Common associates of the type are white elm, white ash, basswood, black cherry and hemlock, with butternut, yellow birch and rock elm typically occurring in the lowland locations of the type. It is extremely important economically in the area, primarily to furniture manufacturing interests. In some areas the type undoubtedly owes its origin to cultural practices such as the removal of beech from Type 57. Almost 14,000 acres, just under 26 per cent of the existing woodland, were mapped as sugar maple, making it the most extensive type in the area.

Type 14A Black Cherry

This type is not common and occurs on the well drained upland hardwood soils and is associated with clear-cutting in the sugar maple types. Its associates may be pin cherry, sugar maple, hemlock, white ash, white elm, aspen, and hornbeam and blue beech. Only 119 acres were found on the Saugeen Watershed, mostly in Egremont Township.

Type 15 Yellow Birch

This type is really an intrusion from farther north and occurs only in the cool, swampy valley floors. Its associates are balsam fir, white cedar and sugar maple. It is of minor importance and comprises only 29 acres of the present woodland.

Type 21 White Spruce - Balsam Fir - Paper Birch

White spruce and balsam fir are the key species of this mixture though they do not always predominate. When the type was mapped paper birch was scarce and often was replaced by white cedar. Aspen, balsam poplar, white elm, tamarack and black ash may also occur. It comprises less than ½ of one per cent of the present woodland and is confined mainly to the occasional shallow rises and dried fringes of the swamps of the Dundalk plain.

Type 22 Balsam Fir

Rarely occurring pure, this type has as its associates in varying proportions white cedar, white spruce, tamarack, black ash, red maple, aspen and white elm. It is found in the poorly drained shallow depressions of the Dundalk Plain, and when the type occurs scattered through the poorly drained valley bottoms, which interlace the hills and rolling plains of the remainder of the watershed, white pine occurs sparsely in the type. Just over 1,900 acres, or 3½ per cent of the present woodland, were mapped as balsam fir.

Type 23 Black Spruce

Black spruce is really an intrusion from farther north and is rarely found as a pure type in the Saugeen area. It occurs in swamps with little or no drainage and often where a peat layer has developed. Its associates are tamarack, white cedar, black ash, balsam fir, white elm and red maple. The black spruce also occurs scattered throughout the very wet cedar and tamarack types but seldom is of sufficient concentration and extent to be mapped as a cover type. Only 17 acres of the type were mapped and all of this is in Glenelg Township.

Type 24 White Cedar

This type occurs on a wide range of sites from the muck soils of the swamps to the droughty upland slopes. It tends to be pure on the better drained areas while in the swamps a number of associates occur such as black ash, white elm, tamarack, red maple, black spruce, yellow birch, hemlock, white pine and white birch. The type is important in the area and ranks in occurrence second only to Type 14 (sugar maple). It occurred extensively in the original cover also and many large stumps are to be found throughout the swamps. It now covers almost 13,500 acres and makes up just under 25 per cent of the remaining woodland.

Type 25 Tamarack

Tamarack occurs in muck swamps with little or no drainage. It may occur pure on very wet sites, but commonly white cedar, balsam fir, black spruce, aspen, balsam poplar and black ash occur in varying proportions as associates. The trees are small and have grown since the near-extinction of the species in the early part of the century. Today the type forms 1.6 per cent of the woodland.

Type 26 Black Ash - White Elm - Red Maple

This type occupies moist to wet muck or peat soils in swamps, depressions of slow drainage, elongated areas along small sluggish streams, and often covers extensive swamps.

Red maple is rarely abundant in the area but black ash and white elm occur in great frequency. Its associates are balsam fir, balsam poplar, yellow birch, white cedar and sometimes tamarack, white pine, basswood and hard maple. Although the "swamp" white elm in this type is not as desirable for some purposes as the "dry" white elm of the uplands, the type is an extensive reserve of this species. Eleven and seven-tenths per cent of the existing woodland was mapped as this type, making it the fourth most important in area occupied.

Type 57 Beech - Sugar Maple

This is regarded as the typical association forming the climax type for the uplands of the region. Its associates are hemlock, white elm, basswood, white ash and black cherry, with hornbeam an important subordinate. The type, like Type 14 (sugar maple), was formerly very extensive in the area but, because it occupied the best land, its area has been tremendously depleted. However, it still comprises close to 12 per cent of the remaining woodland, the greatest part of which is in Glenelg and Bentinck Townships.

Type 59 Ash - Hickory

This type is not listed in the American classification but has been introduced because of its frequent occurrence in Southern Ontario. It is usually a residual type following certain cutting practices and grazing, often of Type 60 (silver maple - white elm), though it may occur on any poorly drained, cut-over area. It is usually composed of a mixture of ash (white, red, green) and bitternut hickory with white elm, basswood, trembling aspen and ironwood as associates. In the area woodlots classed as this type are chiefly ash with some white elm, and bitternut hickory is not common or may be absent. Only 57 acres were mapped and hence it is unimportant as a cover type in the Upper Saugeen Valley.

Type 60 Silver Maple - White Elm

This is a type of the poorly drained soils of the valley bottoms and plains, which are unsuitable for general farming unless adequately drained. For this reason it and the similar types 26 (black ash - white elm - red maple) and 60A (white elm) have survived better than forest cover types on better drained land. Associated species are ash (white, red, green), hard maple, balsam fir. Black ash occurs and where abundant the association may be classed as Type 26. Just over 1 per cent of the woodland was mapped as this type.

Type 60A White Elm

Type 60A is very similar to the preceding type but is found on drier sites as well as swamps. Typically the soft maples are absent, and on the drier sites there may be more frequent occurrence of hard maple, basswood and white ash. The type is not listed in the American classification but has been introduced here because of its frequent occurrence in Southern Ontario where drainage practices may have increased its occurrence in its drier site phase. It makes up 4.3 per cent of the present forest cover.

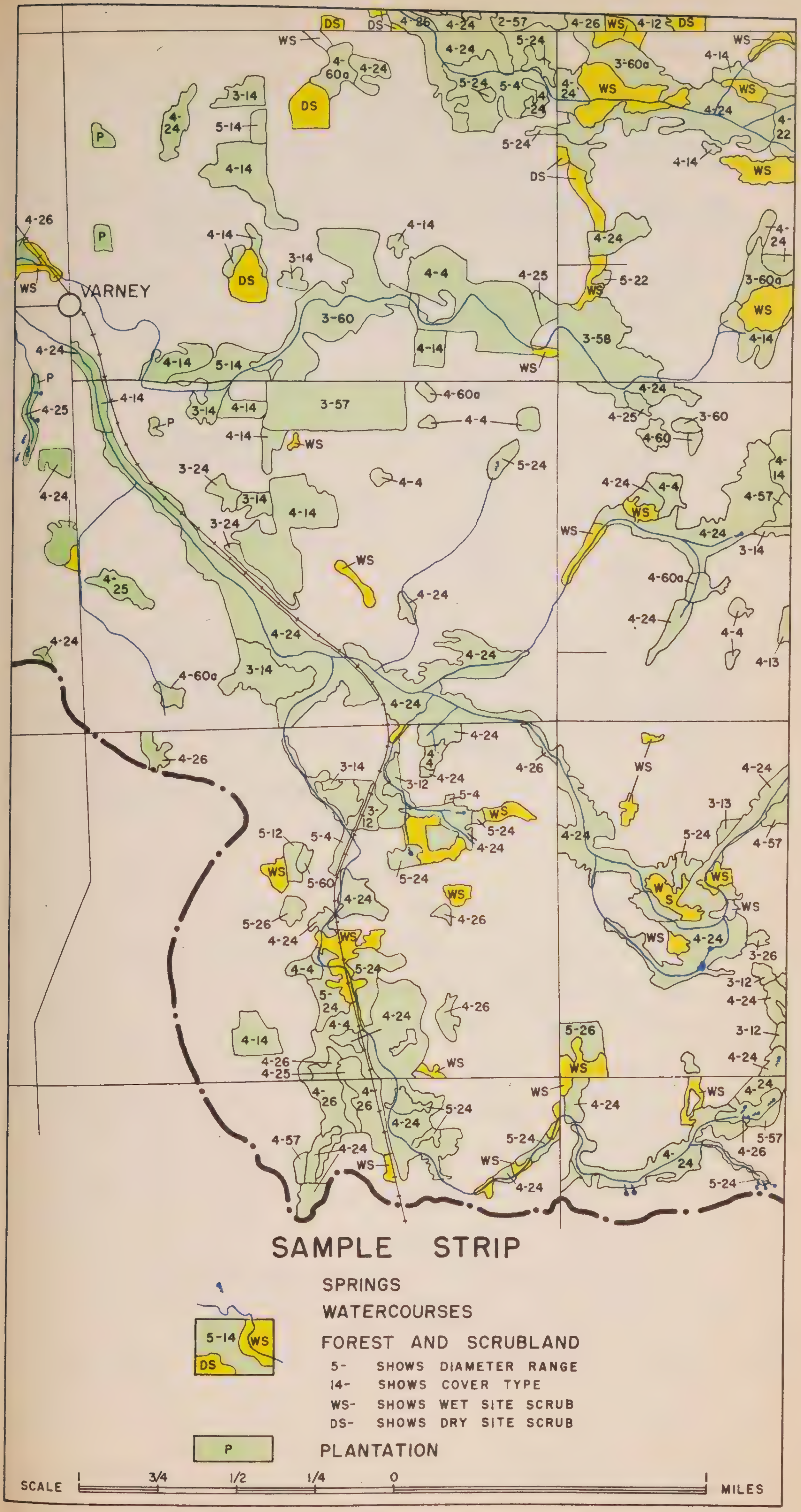
Type 88 Willow

Several willow species are included in this type but the commonest is black willow. It occurs on wet sites, often on the margins of very wet, small depressions or along the main river, especially within town sites. Only 36 acres were mapped in the area.

In review of the species composition of the woodlands as brought out by cover typing it may be noted that:

(a) 21 separate cover types were used, some frequently and some occasionally, to present the picture of the existing woodland.

(b) Of these some are closely related such as sugar maple and beech - sugar maple, while others are distinctly unrelated such as black cherry and black spruce.



VARNEY
SAMPLE STRIP
SPRINGS
WATERCOURSES
FOREST AND SCRUBLAND
5-14
WS
DS
5- SHOWS DIAMETER RANGE
14- SHOWS COVER TYPE
WS- SHOWS WET SITE SCRUB
DS- SHOWS DRY SITE SCRUB
P
PLANTATION
SCALE
3/4
1/2
1/4
0
1
MILES

(c) Two cover types, sugar maple and white cedar, dominate the woodland in the area covered, comprising 50 per cent of the total (12 cover types each comprise less than 1 per cent of the total and six of these occupy less than 100 acres each).

(d) Aspen is the chief pioneer type after cutting and pasturing and is more common on wet sites than on the well drained uplands.

(e) The five most extensive cover types comprise 85 per cent of the total and each of these makes up more than one tenth of the total woodland area as is shown:

Cover Type	Acres	% of Total Woodland	
Sugar maple	13,987	25.7	
White cedar	13,441	24.6	50.3
Beech - sugar maple	6,421	11.8	
Black ash - white elm - red maple	6,403	11.7	
Aspen	6,335	11.6	35.1
		85.4	

(f) The area presently is an important source for hardwood sawlogs and cedar posts and poles. An effective management and marketing plan would recognize the potential of the great areas of inferior hardwood growth and the mixed wood and conifer swamps as a source for kraft pulpwood.

3. Present Conditions

The results of the forest surveys are summarized in the accompanying table and graph.

Woodland within the watershed comprises 54,705 acres which is 21.3 per cent of the total area of 256,211 acres. The total number of woodlots examined was 5,518 which includes many areas which are considered by their owners as constituting a single woodlot but which, because of the difference in types and diameter classes of certain sections, had to be considered in the field as separate units. Conversely, where property boundaries were not marked, woodland extending across two or more properties was sometimes considered as a unit because the type and diameter class remained constant throughout.

The conifers occurring in the watershed are white cedar, balsam fir, tamarack, hemlock, white spruce, white pine

WOODLAND CONDITIONS BY TOWNSHIPS
1951

WOODLAND CONDITION (ACRES)

Township	No. of Woodlots	Area	Aged		Grazed		Fenced		Reproduction			
			Even	Uneven	Yes	No	Yes	No	A	B	C	D
Artemesia	719	7,015	1,916	5,099	3,868	3,147	1,017	5,998	557	1,643	4,074	741
Bentinck	1,357	11,879	6,199	5,680	4,890	6,989	2,066	9,813	1,409	2,802	5,949	1,719
Brant	57	253	68	185	93	160	52	201	28	60	122	43
Egremont	263	2,225	1,215	1,010	560	1,665	440	1,785	266	395	1,154	410
Euphrasia	150	1,805	886	919	927	878	344	1,461	694	528	479	104
Glenelg	1,708	17,824	7,451	10,373	8,461	9,363	2,803	15,021	2,477	4,791	8,623	1,933
Holland	334	3,295	1,469	1,826	1,597	1,698	391	2,904	415	989	1,446	445
Melancthon	50	428	237	191	119	309	5	423		59	367	2
Normanby	136	865	493	372	282	583	120	745	169	119	537	40
Osprey	162	2,549	1,469	1,080	39	2,510	580	1,969	89	433	1,894	133
Proton	468	5,526	1,423	4,103	2,083	3,443	563	4,963	691	1,366	2,957	512
Sullivan	114	1,041	326	715	321	720	21	1,020	156	369	423	93
Total	5,518	54,705	23,152	31,553	23,240	31,465	8,402	46,303	6,951	13,554	28,025	6,175
Per Cent		100.0	42.4	57.6	42.6	57.4	15.4	84.6	12.6	24.7	51.4	11.3

and black spruce. Red pine may have occurred in a few locations in the original forest but no trees from natural seeding were found at the time of the survey. White pine occurs sparsely throughout the swamps of the hilly or undulating areas but is rare in the swamps of the great flats of Proton and Osprey Townships. The species as a tree of the uplands never was common and now has almost disappeared. White cedar is extremely common and is a species of the slopes as well as the swamps. Fir, spruce and tamarack are common as swamp species throughout the area. Hemlock is found mixed with the upland hardwoods and also occurs in the swamps of the hilly or undulating areas.

The hardwoods in the area form a long list and are the common species of the Huron-Ontario Section of the Great Lakes - St. Lawrence Forest Region. However, the occurrence of oak, particularly red oak which may be expected to occur, is rare, and only a few red and bur oak trees were noted by the fieldmen. Sugar maple, white elm, basswood, beech, white ash and black cherry dominate the uplands or better drained areas, while black ash, white elm, balsam poplar, trembling aspen, yellow and paper birch, and silver and red maple are typically the hardwoods of the swamps.

The survey classed the present woodland as:

hardwoods - 28,927 acres or 52.8 % of the total;
mixed woods - 16,213 acres or 29.7 % of the total;
coniferous woods - 9,565 acres or 17.5 % of the total.

The composition of each of these classifications by diameter ranges at breast height is shown.

Diameter Ranges (inches)	Hardwoods		Mixed Woods		Coniferous Woods	
	Acres	%	Acres	%	Acres	%
Over 18	401	1.4	5	0.0		
10 - 18	8,467	29.3	1,141	7.0	116	1.2
4 - 10	15,977	55.2	13,914	85.9	8,424	88.1
Under 4	4,082	14.1	1,153	7.1	1,025	10.7
All	28,927	100	16,213	100	9,565	100

WOODLAND CLASS

Township	No. of Woodlots	No. of Acres	Woodland Class											
			H2	H3	H4	H5	M2	M3	M4	M5	C2	C3	C4	C5
Artemesia	719	7,015	39	761	2,042	515		33	2,458	155			869	143
Bentinck	1,357	11,879	138	2,111	3,172	589		659	3,117	145		49	1,720	179
Brant	57	253	14	53	38	7		12	38		1		88	2
Egremont	263	2,225		558	624	59		53	360	8		11	485	67
Euphrasia	150	1,805		510	611	108			423				150	3
Glenelg	1,708	17,824	193	2,923	5,215	1,488	5	289	3,767	291		55	3,214	384
Holland	334	3,295	17	435	1,391	419		8	579	4			359	83
Melancthon	50	428		17	132	120		87					64	8
Normanby	136	865		159	167	50			229	6			245	9
Osprey	162	2,549		105	856	196			872	280			231	9
Proton	468	5,526		600	1,386	400			1,858	246			907	129
Sullivan	114	1,041		235	343	131			213	18			92	9
Total	5,518	54,705	401	8,467	15,977	4,082	5	1,141	13,914	1,153	1	115	8,424	1,025
			Total Hardwood			28,927	Total Mixed Wood			6,213	Total Coniferous 9,565			
Per Cent		100.0	0.7	15.5	29.1	7.5	0.1	2.1	25.4	2.1		0.2	15.4	1.8
			Total Hardwood			52.8	Total Mixed Wood			29.7	Total Coniferous 17.5			

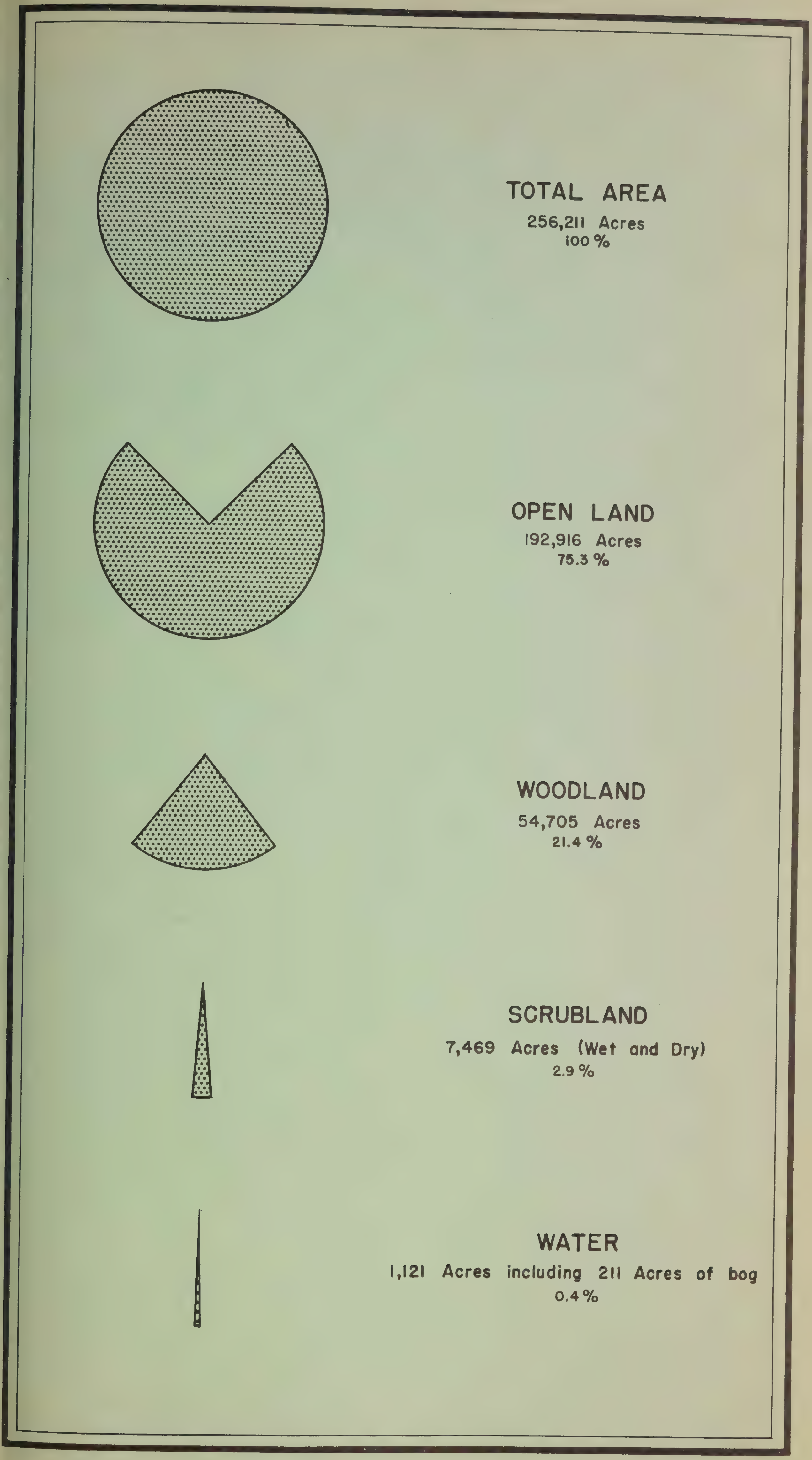
Grazing in farm woodlots is still fairly general, the percentage grazed being 43 per cent of the total woodland. This percentage is low compared with other areas studied in Southern Ontario. Grazing is detrimental to the proper development of any woodland area. The number of cattle and the size of the woodlot have a direct relationship to the damage which is done. For example, a large woodlot is not as seriously affected by a few head of cattle as a small one, but on most farms the woodlot is small and is seriously damaged by large herds. Grazing in woodland is discussed at some length in another section of this report.

The amount of natural regeneration in any woodlot is mainly the result of cultural practices, good or bad, such as grazing, thinning, logging, and of the satisfaction by the conditions present of the re-establishment requirements of the particular species concerned. These requirements may vary considerably from species to species and hence conditions satisfactory for the regeneration of one species may not be for another. For example, hard maple regeneration readily occurs in fairly dense shade whereas trembling aspen requires a considerable degree of light and freedom from root competition for regeneration, as do tamarack and black cherry.

The determination of what is satisfactory reproduction in stands of complex composition is a problem which is not yet well understood. Admittedly it is not entirely satisfactory to place the reproduction of many complex stands in several categories without regard for the age of the stand, the light requirements of the species and other factors; however, it was not intended that this part of the field work be a major undertaking. Reproduction was defined as, in general, growth below one half inch diameter at breast height. By this common yardstick the reproduction in all the woodland of the watershed was classed as:

Excellent	-	12.6%
Good	-	24.7%
Fair	-	51.4%
Nil	-	11.3%

TOTAL WATERSHED



LAND CLASSIFICATION

In many cases the restoration of severely grazed woodland may be desired. Unless it is desirable to change the composition of the stand the economics of natural regeneration should be considered before artificial stocking by planting is undertaken. It may be found that simply fencing the area from livestock will do the job; or a slight scarification of the soil at the correct time of the year might ensure greater success.

Cutting in woodlots and clear-cutting of whole areas has been persistently carried on in the past, but since Grey County enacted its diameter limit by-law in 1947 restricting the cutting of forest trees this latter practice ceased. The results of all past cutting, grazing and other practices acting in conjunction with the natural habits of regeneration of the woodlands are summed up in a general way when the present condition of age spread in the stand is assessed. Using diameter consistency in a stand as an indication of age consistency, the total woodland is classed as nearly 58 per cent uneven-aged and the remainder as even-aged.

4. Scrublands

In this report woodlands are areas supporting species which may reach merchantable size and so have a market value. In contrast to such areas are scrublands. These support woody shrub growth the species of which never reach true or commercial size and have no presently recognized market worth. These areas are recognized in two broad categories - areas of poor drainage, termed wet scrub; and better drained areas, termed dry scrub. Locally these areas are commonly called wasteland or slash land when they are dense or wet enough to interfere seriously with pasture. Some can be restored for pasture by special practices such as draining. These should be returned to woodland on private land. The decision must rest with the owner as to whether or not he is prepared to do the work necessary to clear the land and maintain permanent pasture. If not, tree cover should be restored.

SCRUBLANDS

Township	Area in Water-shed (Acres)	Scrub			
		Dry (Acres)	Wet (Acres)	Total (Acres)	Total % of Tp. Area
Artemesia	38,227	99	1,193	1,292	3.4
Bentinck	64,096	682	1,257	1,939	3.0
Brant	2,515	3	61	64	2.5
Egremont	10,362	40	168	208	2.0
Euphrasia	8,256	9	66	75	0.9
Glenelg	69,517	933	911	1,844	2.7
Holland	14,938	76	139	215	1.4
Melancthon	2,701	0	113	113	4.2
Normanby	4,582	9	77	86	1.0
Osprey	11,475	0	341	341	2.9
Proton	25,939	16	1,122	1,138	4.4
Sullivan	3,603	38	116	154	4.3
Total	256,211	1,905	5,564	7,469	2.9

(a) Wet Lands

The extent of wet scrub in the area surveyed is 5,564 acres or 2.2 per cent of the total area. The growth common to these areas of poor drainage is shrubby willow, dogwood, alder and other woody shrubs which can tolerate very wet sites. Often small clumps of such tree species as poplar, elm, tamarack, black ash and others are associated with the scrub species.

Such areas bear a relation of commercial forest growth in that in many cases they once supported merchantable tree growth. Where the restoration of these areas to commercial forest growth is desired and seems possible in the light of facts known, such should be encouraged by the exclusion of cattle from the area. However, it is known that some of these areas have always had a history of wet scrub growth, and for these areas considerable research is needed into the problems of preparation of the site for commercial growth and the long-term economics of such a project. (See Chapter 4 - Forest Conservation Measures in Progress.)

(b) Dry Scrub

Dry scrub covers 1,905 acres or 0.7 per cent of the total area. The growth consists of hawthorn and sumach, usually on run-down pasture. If the land is not worth restoring to permanent pasture, trees will be the most profitable crop which may be raised and will smother out the scrub growth in time.

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

Forest conservation work in Southern Ontario is carried out under the direction of the Zone Foresters of the Department of Lands and Forests. The office covering the County of Grey is located in Owen Sound and a good deal of reforestation, both private and county, has already been done in the Saugeen Watershed under the supervision of the forester there. This watershed, however, embraces a considerable area of land only suitable for the growing of trees and much remains to be planted.

The nearest forest tree nursery to the Saugeen Watershed is that at Midhurst in Simcoe County, which was established in 1922 and has served as a production and distribution centre for trees ever since. Today, thirty years later, the Midhurst Provincial Forest Station presents a magnificent young forest of pines and other species. Thousands of visitors go to this beauty spot and a small park is provided for their accommodation. Many officials of municipal and other organizations from all parts of the Province have visited this station and returned convinced that all the waste areas of the Province should be reforested and so made useful and beautiful.

1. Private Planting

Reforestation, combined with the protection of natural woodlots, is essential if farmers are to have sufficient woodland to supply the local community with fuelwood, fence posts and poles, and to have a few saw-logs for sale which will provide a cash crop at times when the prices of other farm products are depressed. Reforestation of certain areas will not only mean that the land will be producing a crop where little or nothing of value is growing now, but it will also provide adequate protection for the soil and will retard run-off of water from melting snow and

rain, thus making for a more even stream flow throughout the year. In addition to this, the greatest advantage will be that it will retain the many wood-using industries within the watershed, where the employment they provide will benefit all the members of the river valley community.

The free distribution of trees for planting was first begun in Ontario in 1905, and the following year a statute was passed which permitted a township council to exempt a part of the woodland of a farm from taxation; it provided that exemption be extended to any part of a farm used for forestry purposes or being "Woodlands"; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership.

> "'Woodlands' for the purpose of this paragraph shall mean lands having not less than four hundred trees per acre of all sizes, or three hundred trees, measuring over two inches in diameter or two hundred, measuring over five inches in diameter (all such measurements to be taken at four and one-half feet from the ground) of one or more of the following kinds: White or Norway Pine, White or Norway Spruce, hemlock, tamarack, oak, ash, elm, hickory, basswood, tulip (White wood); black cherry, walnut, butternut, chestnut, hard maple, soft maple, cedar, sycamore, beech, black locust, or catalpa, or any other variety which may be designated by Order-in-Council, and which said lands have been set apart by the owner with the object chiefly, but not necessarily solely, of fostering the growth of the trees thereon and which are not used for grazing livestock." - R.S.O. 1950, c. 24, s. 5 (18)

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

In 1938 The Assessment Act was amended to prevent the assessment being raised on land after it had been reforested and now reads as follows:

> "Land which has been planted for forestation or reforestation purposes shall not be assessed at a greater value by reason only of such planting." - The Assessment Act, R.S.O. 1950, c. 24, s. 33 (12)

Both these Acts were designed to facilitate the planting of trees on private land and should be taken

To aid in reforesting marginal lands the Authority is renting a tree-planter at nominal cost to landowners. This machine will plant up to 10,000 trees per day.

Where seed trees are present, white cedar will often reforest an area naturally if cattle and fire are excluded.

In some locations hardwoods too will reforest the land, particularly on the lee side of existing woodlots.

advantage of by citizens anxious to improve woodland conditions on their own property and at the same time benefit the whole community of the river valley.

Within the Upper Saugeen Watershed there are 348 private plantations, most of which are small, namely two to twenty acres in area. The most extensive are in Holland and Bentinck Townships though the oldest are near Wilder Lake in Egremont.

More and more land is being reforested by private owners each year and the Authority maintains a tree-planting machine which it rents at a nominal sum for this purpose.

2. <u>County Forests</u>

The County of Hastings was the first in the Province to interest itself in reforestation and as long ago as 1911 appointed a reforestation committee which was instrumental in having the Counties' Reforestation Act passed which has since been incorporated in The Trees Act. The committee also recommended* that "The Corporation of the County of Hastings purchase from the municipality of the Townships of Elzevir and Grimsthorpe certain lands containing 2,800 acres, more or less, for $200" as the nucleus of a county forest. However, no further action was taken and the Act lay dormant till 1922 when the present policy of county forests was laid down. The work is done under the authority of The Trees Act (R.S.O. 1950, c. 399), which provides for the purchasing of land and the entering into agreements by the county for the management of such lands. No limit as to the size of the area is stated, so that some counties have plots of a few acres while others have forests of several thousand acres. If, however, a county wishes to enter into an agreement with the Minister of Lands

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* Minutes of the Meeting of the Council of the County of Hastings, December 8, 1911.

and Forests for the planting and management of such county-owned land, it is preferred that the county purchase not less than 1,000 acres. The agreements which are in force at the present time run for a period of 30 years, during which time the Ontario Government agrees to establish the forest and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc. - in short, everything connected with the management of the forest.

At the end of the 30-year period the county has the privilege of exercising one of three options: First, to take the forest over from the Government and pay back the cost of establishment and maintenance, without interest; second, to relinquish all claim to the forest whereupon the Government will pay to the county the cost of the land, without interest; third, the forest may be carried on as a joint undertaking by the Province and the county, each sharing half of the cost and half the profits.

It will be seen from the above summary of the agreement that all a county stands to lose on such a project is the interest for 30 years on the purchase price of the land. Also, it should be pointed out that, in drawing up such a liberal scheme, it was done purposely to encourage the reforestation of land not suited to agriculture. Again, it was not the intention of the Government to have the counties stop at a minimum of 1,000 acres, as the overhead necessary on an area of this size could very easily be spread over an area of five or even ten times the size. As a matter of fact this is what happened in some counties where the councils have initiated a progressive reforestation policy.

This Act also provides that municipal councils of townships shall have all the powers, privileges and authority conferred on councils of counties except that, instead of issuing debentures to an amount not exceeding $25,000, they shall have power to levy, by special rate, a sum not exceeding $1,000 in any year, for the purpose of

providing for the purchase of land for planting and protecting the timber thereon.

Grey County has a forest of over 4,200 acres in a number of tracts throughout the county; 2,037 acres lie within the Upper Saugeen Watershed, including the Main Tract in Glenelg Township which comprises 735 acres. This forest is being constantly added to, the open land reforested and the existing woodlands managed under the direction of the Zone Forester.

3. Authority Forests

The agreements which have been drawn up between the Ausable, Ganaraska, Grand, Humber, Moira and Thames Authorities and the Ontario Government to establish and manage the Authority forests is substantially the same as that made with the counties, except that the Government has agreed to pay half the cost of the land and the agreement for planting and management is to run for approximately fifty years. County-owned lands are tax-free but Authority-owned lands are not; consequently many townships prefer the Authority type of agreement.

4. Municipal Forests

Municipal forests are owned and managed by municipalities other than counties.

There are two plantations which may be considered municipal plantations, one near Durham and the other just outside the Upper Saugeen Watershed near Hanover. Between 1933 and 1946 the Town of Durham planted some 15,000 trees, mostly along the banks of the Saugeen River. During the period from 1927 to 1936 the Town of Hanover planted the area from which it derives its water supply with trees and now has a fine municipal forest of about 85 acres.

Assistance with regard to the establishment of municipal forests and the supplying of free trees is still the policy of the Department of Lands and Forests. Moreover,

as provided by The Trees Act (R.S.O. 1950, c. 399), it is possible for a township council to enter into an agreement with private landowners for the reforestation of their property. The agreement will prescribe the cutting conditions of all trees planted and such conditions will be subject to the approval of the Minister of Lands and Forests.

Provision is also made for exempting such lands from taxation and for making arrangements with the Dominion and Provincial Ministers of Labour regarding conditions of labour and payment of wages in connection with planting and conservation of such areas. - The Trees Act.

Before leaving the subject of municipally owned forests and forests which on a large scale would provide the local communities with at least a part of their livelihood, it would be as well to review what is being done along these lines in other places.

In Nova Scotia there is a community living on Hammonds Plains near Halifax, which depends entirely on wood taken from small woodlands for its livelihood. In this the largest woodlot is not over 400 acres in extent and because of the rocky nature of the soil the people are not able to augment their incomes by farming, though most families own a cow, a pig and some chickens. The wood from the woodlots is manufactured into barrels and boxes by more than twenty small mills which are largely family-owned and -operated. The people are thrifty and industrious; they have comfortable homes, are public-spirited and extremely forest-fire conscious. This is a community which has developed naturally and yet resembles communities based on a forest economy which have been planned and established in Europe for a considerable time.

One of the most recent is the Forest of Ae in Dumfriesshire, Scotland. It was established by the British Forestry Commission in 1927 and covers an area of 10,683 acres of which 3,000 acres have been planted, 4,500

acres are scheduled for planting in the near future, 250 acres of the best land have been set aside for cultivation, and the balance of 2,800 acres is unplantable because of its altitude but is used for sheep pasture in summer.

The forest is in charge of a forester who resides on the spot and under him there are foremen and gangs of workers. In the first year 16 men were employed; just before the war 27 full-time employees were engaged; and by 1960 about 90 men (or one man for each 80 acres) will be needed the year round for essential forest work. This does not take into account temporary employees who will be required for sawmilling, transport and other jobs. It is planned to create a forest village for the workers embodying a church, a school, playgrounds and sportsfields. The combination of the forest and the village dependent on it is something new in Scotland and represents an important stage in the resettling of men and women in the country. The village is to be the forerunner of other similar villages and in many parts existing villages will be revitalized by the stimulus of forest wealth.

5. Demonstration Plantations

In 1922 the Provincial Government began the policy of assisting municipalities in the establishment of small forest plantations for the purpose of demonstrating the use of trees on marginal and submarginal land. To meet the requirements for such a plot the Government required that the area be on a well-travelled road so that as many people as possible could see it; that the municipality either purchase land or use land which was in its possession, fence it, and agree to give the area reasonable protection after planting. In return the Government agreed to supply the trees and pay the cost of planting and of supervising the work when the planting was in progress. In 1932, when Government funds were curtailed, the policy governing these demonstration plots

Demonstration woodlots have been established throughout the watershed by the Zone Forester in co-operation with interested owners, and serve to illustrate good forestry practices in woodlot management.

The County of Grey has reforested many areas of marginal land throughout the watershed. This shows a portion of the McWilliams tract.

This private plantation near Wilder Lake is being thinned for pulpwood, leaving the larger trees to develop into saw-logs.

was changed, and from that time to the present the Government has not paid the cost of planting, although the other conditions governing the establishing of these plots have remained the same. The Hanover waterworks forest was originally set out as a demonstration plantation in 1927.

The value of such plots, if well cared for, in showing landowners what can be accomplished in a very few years by planting trees is so great that every township should endeavour to establish at least one plot.

6. Demonstration Woodlots

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management, outlined by the Department of Lands and Forests, under the Zone Forester and to permit access to the area by interested persons. Such demonstration woodlots and the influence they exert for the proper management of similar areas contribute to the total conservation effort in any watershed.

Six demonstration woodlots have been established in the Upper Saugeen Watershed.

7. School Forests

In order to encourage the establishment of school forests planted and cared for by school children, the Ontario Horticultural Association in 1945 organized an annual competition. Prizes are offered for the school having the best plantation and knowledge of forestry in each forest district in Southern Ontario and for provincial winners from the winners in the district. Prizes for these competitions are generously provided by the Ontario Conservation Association and by private donors.

Many schools in the area have entered these contests in the past and several schools have taken prizes in the district competitions.

Trees have also been sent out to schools in the watershed and have been distributed to children for planting on the home farm, and many of these have been used to form shelterbelts and windbreaks. The number of trees distributed for this purpose is shown in the accompanying table.

8. <u>4-H Clubs</u>

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age and each member undertakes a project such as marking a half-acre plot of woodland for thinning or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes $3.00 per member and the sponsoring organization $1.50. Winners may enter the Provincial Inter-Forestry Club Competition.

9. <u>Financial Returns from Reforestation</u>

In addition to indirect benefits such as ground-water supplies, amelioration of floods, wildlife protection and other influences, reforestation has definite financial returns. In support of this the following data are submitted, based on studies of reforestation areas in Southern Ontario, some of which are 40 years of age. Red pine is used as an example because it thrives on sandy soils, has few serious insect and disease enemies, and has splendid marketing possibilities during the early years of rotation in the form of poles and pulpwood. The data here given are based on an area of at least 1,000 acres, which allows for sufficient spread for supervision. Furthermore, it should be pointed out that over the years there has been a considerable fluctuation in the cost of planting, price of land, and

to a lesser degree in the cost of supervision. Land costs have been as low as $2 or $3 per acre; planting costs have been considerably less than shown, and can be reduced by the use of more planting machines. The cost of supervision is based on the salary of a resident caretaker on 1,000 acres, although this could be reduced further if the area under supervision were 2,000 or 3,000 acres.

Costs of Red Pine - 60-Year Rotation

Trees Planted 8 x 8 or 680 Trees per Acre
3% Compound Interest

Item	Amount $	Total in 60 Years $
Land	10.00 per acre	58.91
Planting, including trees	20.00 per acre	117.82
Management	2.00 per acre per year	326.10
Taxes	10.00 per acre (land only)	65.00
Total for one acre		567.83

Returns from One Acre of Red Pine

60-Year Rotation
Trees Planted 8 x 8 or 680 Trees
(All figures based on stumpage values)

1. Thinnings of 200 trees at 30 years of age

3,000 bd. ft. @ $20.00	$60.00
10 cords pulpwood @ $3.00	$30.00
	$90.00

2. Thinnings of 150 trees between 40 and 55 years of age

5,000 bd. ft. @ $20.00	$100.00
15 cords pulpwood @ $3.00	$ 45.00
	$145.00

3. Allowing for losses from the 680 trees planted, it is estimated that there should be at least 200 dominant trees left for the final crop.

200 15-inch trees for saw timber,

30,000 bd. ft. @ $20.00 .... $600.00

or

4. 200 15-inch trees as poles, at present

Crown stumpage rates 700.00

5. Previous returns from thinnings could be put back into the operation, or kept separate as a credit at the end of the rotation.

(1. above) $ 90.00 for 30 years @ 3%	$218.00
(2. above) $145.00 for 10 years @ 3%	$194.87
Total per acre	$1,012.87
If poles harvested (4. above) add $100.00	$1,112.87
Deduct cost of establishment per acre	$ 567.83
Net profit per acre	$ 445.04

CHAPTER 5

FOREST CONSERVATION MEASURES REQUIRED

1. General Aspects

One of the most important conservation measures required on the section of the Saugeen Watershed surveyed in 1951 is the establishment and management of several areas of forest to be known as the Saugeen Authority Forest under the Saugeen Valley Conservation Authority. (See table, text and series of maps which follow. The large map mentioned in Chapter 1, but not included with this report, shows the existing forest on these areas by species and diameter ranges as recognized by the cover typing technique, outlined in Chapter 1.)

The percentage of forested land which should exist on a given watershed is determined solely by what, in the final analysis, is economic return. Whether the percentage is high or low is incidental to this fact and should be neither praised nor condemned if every parcel of land on the watershed is being put to its best use in accordance with existing concepts of proper land management. The selection of areas for acquisition by the Saugeen Authority for forestry purposes was based on this principle. It is strongly urged that the Authority provide support for the continuation of their forestry projects by careful cost accounting of each area they manage, to give supporting data to this principle. It is only by the collection and analysis of such data that these necessary works will receive public endorsement and show the way to private owners. Dollar proof is a convincing lever to any rural or urban resident.

Two classes of reforestation land are present:

(1) That best suited for private reforestation
(2) That best suited for acquisition by the Authority.

2. Private Reforestation Required

On many holdings land suited only for tree growth could be privately planted and the program integrated with the general farm operation. These areas are usually small sections

LAND CLASSIFICATION
AREAS RECOMMENDED FOR SAUGEEN AUTHORITY FOREST

Area	Acres				
	Open	Wood-land	Scrub *	Water	Total
1. Marl Lakes	86	68	4	23	181
2. Hanover	262	120	40	28	450
3. Habermehl Creek	195	204	1		400
4. Boyd Lake	383	247	40	27	697
5. Lamlash	163	166	71		400
6. Allan Park	1,075	746	53		1,874
7. Aberdeen	236	32	32		300
8. Rocky Saugeen	73	96	29		198
9. Harrison Lake	546	618	59	27	1,250
10. Dornoch	555	477	34	9	1,075
11. Styx River	483	487	27	3	1,000
12. McKechnie Creek	191	194		14	399
13. Tobermory Lake	355	490	81	1	927
14. Durham	458	118	52	5	633
15. West Varney	84	66	8		158
16. East Varney	147	133			280
17. Tartan	123	22	7		152
18. McWilliams Station	1,053	449	17		1,519
19. Bunessan	230	131	39		400
20. Glenelg Centre	1,456	1,043	73		2,572
21. Irish-Farden Lakes	1,878	2,609	129	41	4,657
22. Bells Lake	515	1,271	19	215	2,020
23. Walker Lake	599	205		26	830
24. Harkaway	188	254	2	6	450
25. Holland Gore	309	211	27	3	550
26. Markdale	834	758	73		1,665
27. East Priceville	408	199	40	1	648
28. South Priceville	139	115	6		260
29. Saugeen Junction	49	272	95		416
30. Proton Swamp	102	870	348		1,320
31. Osprey Swamp	283	1,667	186	211 (bog)	2,347
Total	13,458	14,338	1,592	640	30,028

* Scrub - shrub growth of species which never reach commercial size; recognized in two classes, wet-site or dry-site (not separated here).

of bouldery land or poorly drained pockets on lots which are, on the whole, best suited for agriculture. The Land Use Section provides a map of Recommended Land Use and on this are shown all areas suited only to forest growth (only areas greater than 25 acres were mapped).

It is recommended that the Authority encourage in every way possible the private reforestation of these areas. It is pointed out that the temporary loss of the small current income from such areas can be more than offset by improved practices elsewhere on the property. It is recommended that the Authority, in addition to encouraging such a program by making available tree-planting machines to any owner wishing to reforest, provide a trained crew of tree-planters to reforest land by hand where a tree-planting machine cannot be used.

3. The Proposed Saugeen Authority Forest

The recommended Saugeen Authority Forest totals 30,028 acres. The acreages were taken from aerial photographs and have been adjusted to agree with assessment records in total only, as the land classification figures in such records are quite different from those determined by this survey. The difference arises chiefly in the definition of woodland. Where assessors call a swamp or a slash area with very young growth wasteland, the survey called it woodland, and many areas classed as pasture in assessment records are woodland according to the survey definition.

The survey classified the recommended Saugeen Forest areas as follows:

Open land	13,458 acres or 44.8% of the total
Woodland	14,338 acres or 47.8% of the total
Wet and dry site scrubland	1,592 acres or 5.3% of the total
Water (including 211 acres of bog)	640 acres or 2.1% of the total

RECOMMENDED FOREST AREAS
1. MARL LAKES
2. HANOVER
3. HABERMEHL CREEK
4. BOYD LAKE
5. LAMLASH
6. ALLAN PARK
7. ABERDEEN
8. ROCKY SAUGEEN
9. HARRISON LAKE
10. DORNOCH
11. STYX RIVER
12. McKECHNIE CREEK
13. TOBERMORY LAKE
14. DURHAM
15. WEST VARNEY
16. EAST VARNEY
17. TARTAN
18. McWILLIAMS STATION
19. BUNESSAN
20. GLENELG CENTRE
21. IRISH-FARDEN LAKES
22. BELLS LAKE
23. WALKER LAKE
24. HARKAWAY
25. HOLLAND GORE
26. COOPER
27. EAST PRICEVILLE
28. SOUTH PRICEVILLE
29. SAUGEEN JUNCTION
30. PROTON SWAMP
31. OSPREY SWAMP
35 RECOMMENDED FOREST AREAS
LANDSCAPE TYPES
HOLLAND RIDGE
HANOVER SANDY PLAIN
BENTINCK WHALE BACK HILLS
DURHAM ROLLING PLAIN
GLENELG GRAVELLY HILLS
MARKDALE ROLLING PLAIN
DUNDALK SILTY PLAIN
SWAMPY SAUGEEN FLATS
SCALE MILES
1/2 0 1 2 3 4 5

The high percentage of existing woodland in the total recommended area is the result of the following factors:

(a) Almost every lot in areas of low agricultural capability is wooded to some extent.

(b) In some cases recommended forest areas have been extended to include some lots which are almost entirely wooded. A good example of this is the Harrison Lake block, and in its description later in the text the good business principle of including such areas is very briefly outlined.

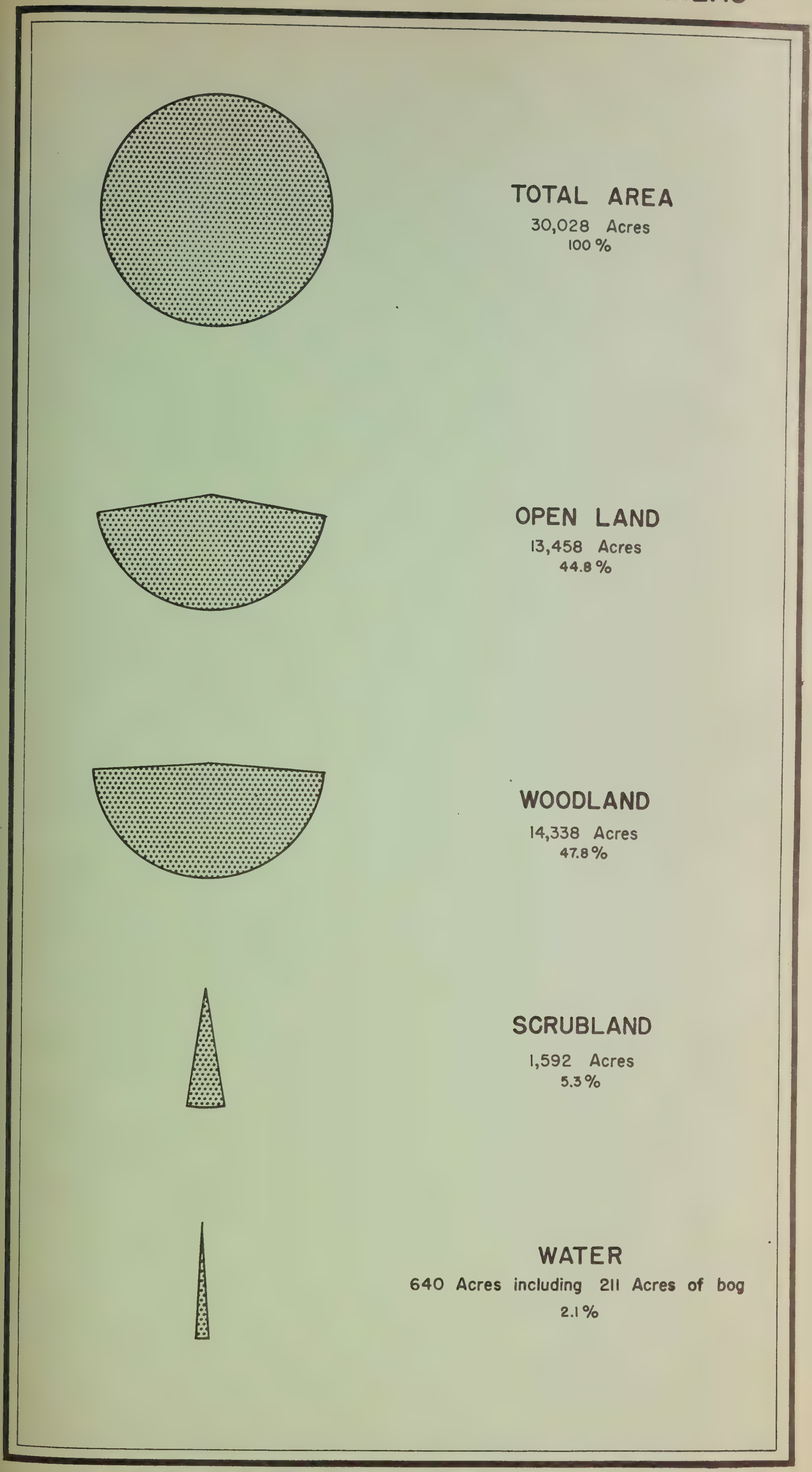
(c) Four areas (Bells Lake, Saugeen Junction, Proton and Osprey Swamps) are almost entirely wooded now but have been recommended for observation by the Authority, solely because of their effect on stream flow. These areas should be acquired and managed if such proves desirable.

The 30,028 acres recommended are found in 31 more or less separate blocks of land. These have been numbered and given names which seemed appropriate for their identification. The names are generally those of places, streams or lakes near or in the areas. The series of maps which follows shows these areas identified by the numbers allotted to them in the descriptive text which follows:

The text describing the areas makes use of the descriptive names applied to the landscape types recognized in the Land Use part of the survey and their descriptions appear in that section. The names given to the landscape types are also listed at the foot of the first page of the Forestry Section, with their physiographic equivalents. A one-page map follows, which shows the locations of the recommended forest areas superimposed on the landscape types. From this it may be seen that most of the recommended forest areas are associated with two quite similar landscape types which are called the Glenelg Gravelly Hills and the Holland Ridge. On these together occurs close to 70 per cent of the recommended area.

This map locating the recommended areas relative to the landscape types should be compared with the Farm Classification map in the Land Use Section and the text related to it should be studied. Such a comparison shows that a large number

RECOMMENDED AUTHORITY FOREST AREAS



LAND CLASSIFICATION

of the lots on these same landscape types mentioned have been abandoned as farmsteads and many of these are included in the recommended forest area. The attention of the Authority for reforestation work is directed to these two belts of land which exhibit features indicating that the greatest return from them will be from managed forest. Some of the recommended areas may be considered before others for early action by the Authority. For these see the text describing the areas.

(a) <u>Field Considerations in the Selection of Areas to be Acquired</u>

Basic assumptions and policy coupled with field observations determined the areas to be recommended for acquisition. How these are interrelated is outlined:

(1) Land capable of supporting agriculture should be retained as such. Some land, however, is suitable only for woodland development.

(2) As much land as can be operated with sound land use and conservation practices should be left in private ownership, because

<u>a</u> It preserves private property rights;

<u>b</u> secures maximum intensity of use;

<u>c</u> minimizes the immediate cost to the Authority of a conservation program.

(3) Land would be acquired in a manner consistent with lot and concession divisions.

(4) The blocks of land recommended should be extensive in area and in most cases serve as cores, around which future expansion will develop.

Field observations determined:

(1) That there was insufficient land on the lot or lots to support a farm family at a standard of living comparable with that generally accepted as adequate in Southern Ontario.

(2) That an early consolidation of these areas into the operations of an adjacent farm holding to attain the maximum economic use of this land was improbable.

(3) That private reforestation on the lot or lots, by the present owners, was improbable and hence the current loss of wealth to the community due to the utilization of land below the maximum potential would continue.

Decisions with respect to these factors of selection were reached by the scientific measurement of conditions.

(1) Natural land conditions such as boulderiness, steepness of slope, etc., were observable and measurable in a manner in accordance with approved standards of field operation.

(2) An ownership map of the land on the watershed was prepared. From this map the size of the holdings and their consolidation pattern were attainable.

(3) The assessment values were obtained for the general regions in which the acquisition areas were located. Although these data were not in themselves an absolute guide for the selection of acquisition areas, they did provide an additional check on deductions.

(4) The judgment of what constitutes a sufficient area of arable land to support a farm family was largely subjective.

- No economic farm studies were undertaken to determine the minimum holding able to support a family under varying soil and land conditions.

- During the summer's field work in the area, valuable impressions were gained from continual observation of and familiarity with all classes of farms in the watershed. A classification was made of all farms on the watershed and the results of this work were a useful guide. (See Land Use Section.)

- Conditions at either extremity of the scale presented little difficulty. Over 100 acres of good arable land was sufficient, while 15 acres was obviously too small to support a family by general farming practices.

- On the marginal cases, the decisions were most subjective. The quality of the arable land largely determined the amount necessary and the distribution of the arable land was important. Whenever a case for acquisition was marginal it was decided to recommend the plantable areas for reforestation by the present owners.

(b) Detailed Description of Acres

(1) Marl Lakes

Comprising only 181 acres, this is one of the smallest areas recommended for acquisition by the Authority. It is a flat-bottomed, steep-sided valley entrenched in the sands and gravels of the Hanover Sandy Plain. The valley slopes are seriously eroded and in places secondary or tributary valleys are developing. The upper reaches of the Marl Lakes are located in the south section of the area. The area is classed as 86 acres of open land, 68 acres of woodland, 4 acres of scrub land and 23 acres of water.

(2) Hanover

This area is at the junction of two landscape types, the Hanover Sandy Plain and an outlier of the Glenelg Gravelly Hills. The western part of the area is steeply sloping hummocky sand lands with small pockets of blowing sand, while the eastern part is gravelly hills and ridges. About 60 per cent of the area is open land. A number of springs, which arise in the woodlands, feed the several small lakes, which cover about 28 acres of the property. The lakes are surrounded by the typical wet-site conifers and hardwoods of the region. The area totals 450 acres.

(3) Habermehl Creek

Hummocky and bouldery land with fragment kettles and swampy depressions describes this area, which is typical of much of the Holland Ridge land. The 400 acres is about evenly divided between wooded land and open land used as rough pasture. Most of the area presently under tree cover is extremely rough. The area is in the headwater region of Habermehl Creek and the height of land separating this drainage from that of the Deer Creek basin follows the Holland Ridge through this block.

(4) Boyd Lake

The northern section of this area is very similar to the preceding area and steep unmanageable slopes with stony gravelly soils are the rule. The 27-acre lake in the block drains south to the Styx River, through a long neck of poorly drained land which has also been included for acquisition. About

35 per cent of the 697 acres is at present wooded. Much of this is at the north end of the area and is second growth upland hardwoods which grow well on this kind of topography. At the time of field observations natural regeneration of hard maple was evident in the pastures in the lee of some of the woodlands. This is by far the best way to re-establish tree cover on many such lands.

(5) Lamlash

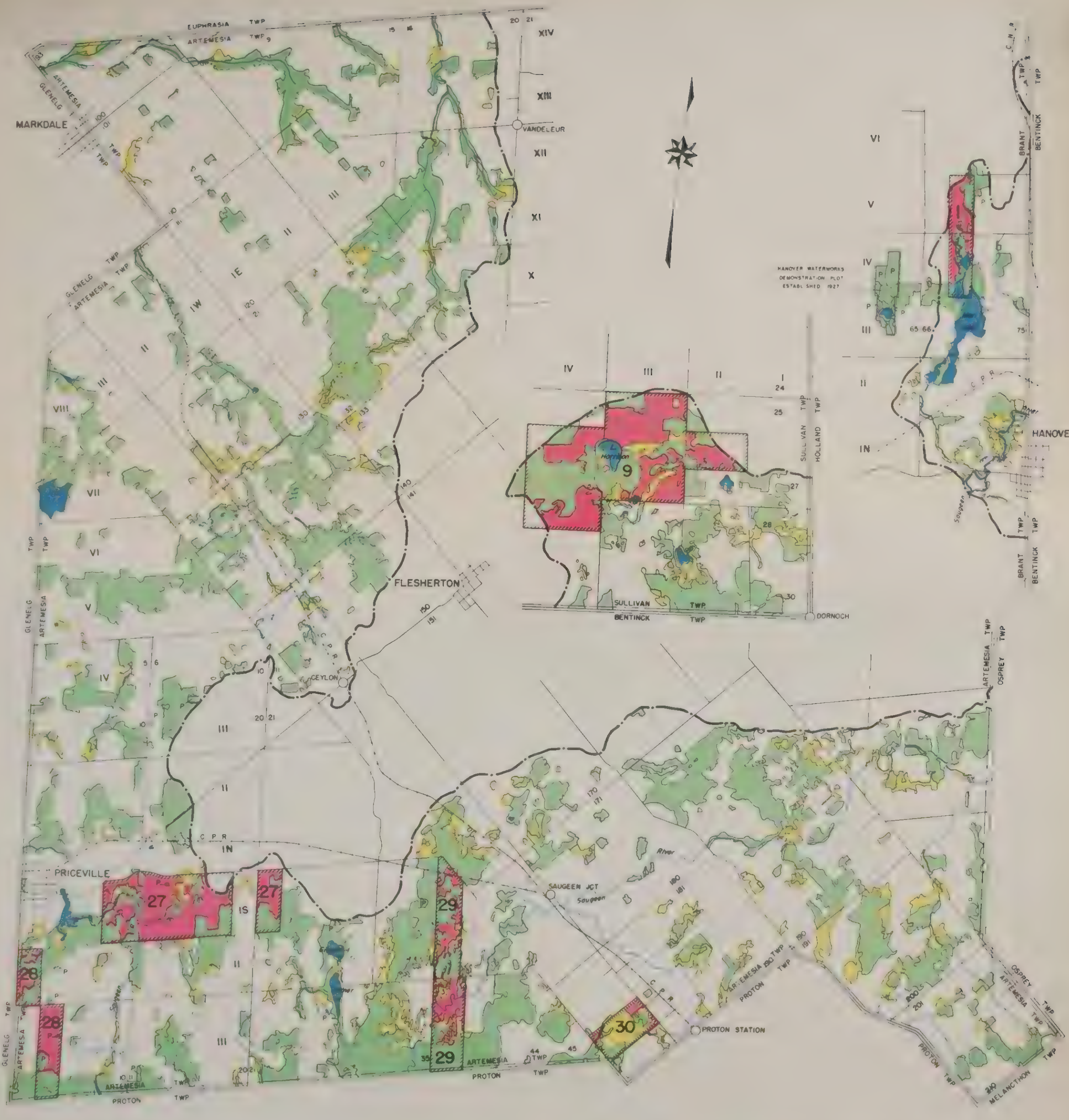
The eastern 300 acres of this area is rolling hills, mostly of fine sand and gravel, and is much broken by a pattern of poorly drained depressions now occupied by swamp conifers and hardwoods or woody shrubs. The western segment of the area is all muck land covered by swamp woodland and marsh growth. The whole area lies astride a small tributary of the Styx River.

(6) Allan Park

This area is located on an outlying extremely steep, rough and bouldery section of the Glenelg Gravelly Hills and some of the very roughest topography of the watershed is found here. This is one of the largest blocks of land in the area recommended for acquisition for forestry purposes. Of the 1,874 acres in the block, 1,075 acres or nearly 58 per cent is open land, 40 per cent is presently covered by some form of forest growth, including about 35 acres of plantation, and 53 acres is classed as wet-site shrub growth. In a priority scale for early adjustment to forestry practices based on land capability alone, this area ranks very high among all those recommended for acquisition; but in addition the Authority might consider that certain features of the area increase its priority for early planned development. These are:

a A strip of the property crosses the highway between Hanover and Durham, giving the area great value as a demonstration unit.

b Adjacent to the recommended forest area and also against the highway are lots well suited to demonstrate pasture improvement and other economic aspects of good land management.



AREAS RECOMMENDED FOR THE

SAUGEEN AUTHORITY FOREST

ARTEMESIA, SULLIVAN AND BRANT TOWNSHIPS

DEPARTMENT OF PLANNING AND DEVELOPMENT – CONSERVATION SURVEY–1951

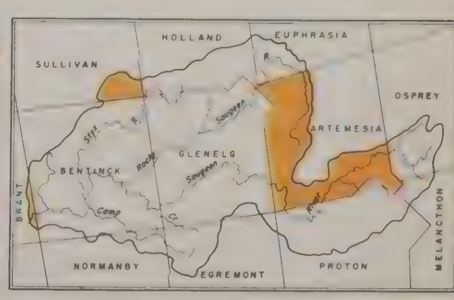
- RECOMMENDED AUTHORITY FOREST AREAS
- EXISTING WOODLAND
- SCRUB LAND
- PLANTATION
- SPRING
- TOWNSHIP BOUNDARY
- UPPER SAUGEEN WATERSHED BOUNDARY

SCALE - MILES

3/4 1/2 1/4 0 1 2

KEY MAP

SHOWING PARTS OF TOWNSHIPS ON THIS PLATE.



c Recreational values of the block are evident for both summer and winter in:

(i) A very productive trout stream, Camp Creek, which cuts across the north-east part of the block in a deep, steep-sided valley;

(ii) A ski tow is located on the property.

(7) Aberdeen

This block lies across the steep, rough valley of the Main Saugeen River; bouldery valley slopes, eroded gravelly hummocks, and poorly drained flats are the land features. The tree growth on the area is mainly small river-bank groves of elm and maple; perhaps half of the total area, now in very rough pasture, has never been cultivated. Stumps of impressive size in part of the area are all that remain of one of the not very common white pine groves of earlier days in this section.

Charles Rankin, one of the early Provincial Land Surveyors, made reference to these pine. In 1837 he was running a line for the proposed Garafraxa Road (now Highway No. 6). His line was west of the present highway by two to three miles from near Owen Sound (then Sydenham) to Fairbanks Creek just north of Mount Forest, after which it coincided with the road of today down to Garafraxa Township. The line was blazed on September 7, 1837, through the forest a few hundred yards west of the three lots described above.

(8) Rocky Saugeen

This 198-acre area is situated mainly on the steeply sloping, sandy, gravelly and erodible north shoulder of the valley of the Rocky Saugeen near the community of the same name on Highway No. 6. About half the area is now fairly well stocked woodland, mostly upland hardwoods, although some is very young. The remainder of the area, except for a very small pocket of cultivated land, is being invaded by cedar and hawthorn, making it at best very poor, rough pasture.

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* Rankin, Charles. Report, Garafraxa Road, 1837. Surveyors' Letters, Rankin, No. 82.

(9) Harrison Lake

The rough stony land of this area is much like that of the Boyd Lake and Habermehl Creek blocks which are on the same landscape type, the Holland Ridge. Of the total of 1,250 acres, half is now in some form of forest cover, and 546 acres is open land including about 40 acres of marsh. Harrison Lake and another small lake on the property are depressional lakes with no surface outlets. The existing woodland, both upland hardwood and lowland mixed wood, is dominantly hardwood. The north-western section of the area is mostly woodland now held by furniture interests and is an excellent stand of sugar maple, beech and basswood, much of which is classed as 10-18 inches in diameter. The inclusion of good woodland in an acquisition area, intentional here but often unavoidable, increases initial costs for the property but has the advantage of rounding out the area as an economical work unit. Woodlands now merchantable or nearly so will provide winter work in both logging and marketing besides being a source of revenue to offset costs and management of areas not yet productive.

(10) Dornoch

This block lies astride a bouldery and hummocky section on the southern flank of the Holland Ridge and a deeply entrenched valley fronting it. Swampy hollows with no surface drainage outlets are common and several small ponds on the area exhibit a marked seasonal variation in level. The Styx River flows through the southern section of the block and is fed by several small tributaries which have their sources in the area. The area totals 1,075 acres of which 555 are open land, 477 acres are wooded, 34 acres are scrub land and 9 acres are water surface.

(11) Styx River

In land features this block exhibits an intricate pattern of poorly drained hollows and valley floors, combined with rough and bouldery phases of the Bentinck Whale-back Hills.

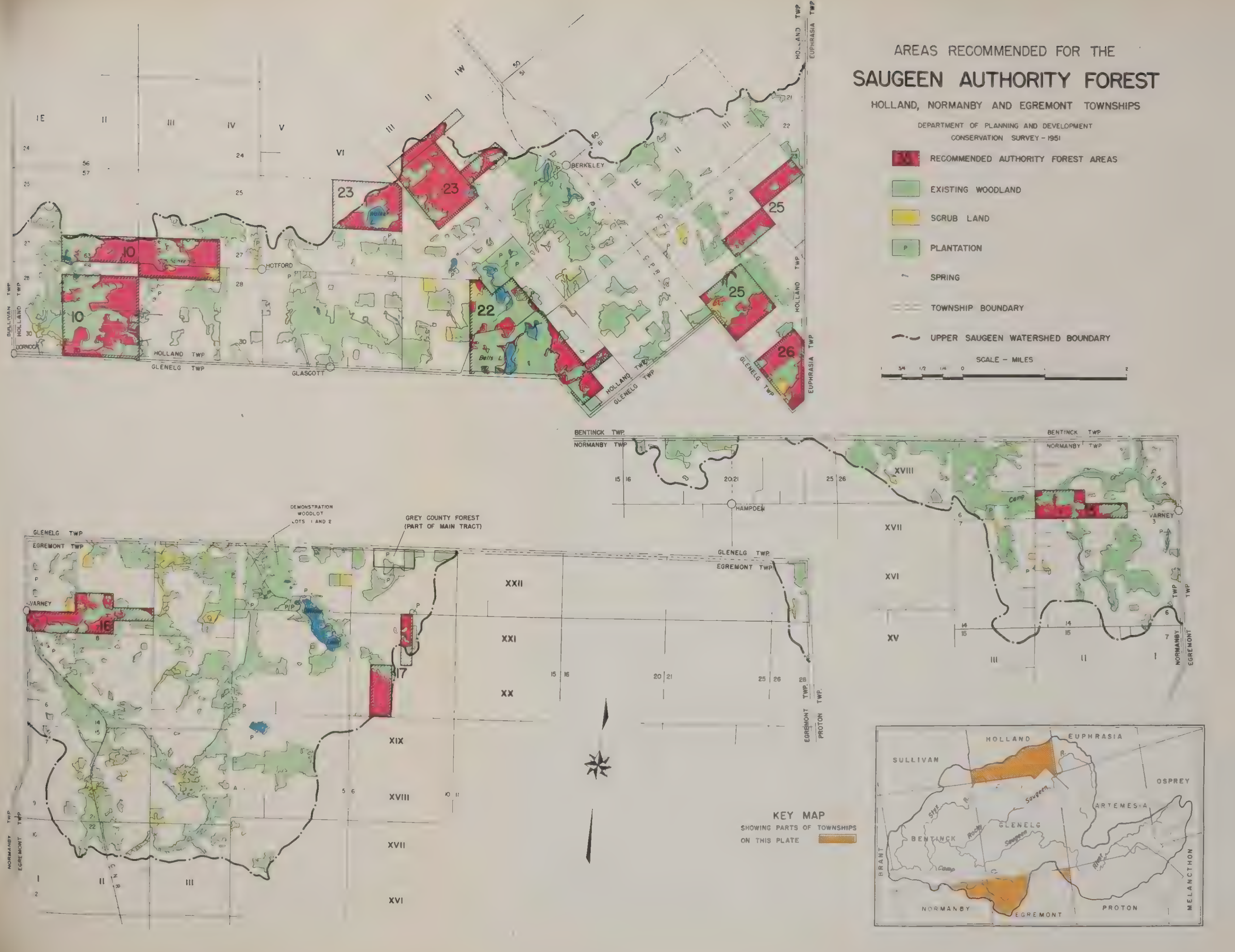
The area forms the divide between the headwaters of McKechnie Creek and a tributary of the Styx River. About half of the 1,000 acres is now in forest cover and both good upland hardwoods and swamp conifers and hardwoods are represented, occurring well spread over the diameter ranges from very young growth to merchantable sawlog stock. (The area lies on two sides of the 400-acre Kenny Tract of the Grey County Forest which was acquired in 1946 at an average cost of $6.81 per acre.)

(12) McKechnie Creek

The block is associated with rough phases of the eastern section of the Bentinck Whale-back Hills and sandy deposits. A considerable part of the area is poorly drained comprising kettles and swampy valley flats. The north-west section contains a small lake and borders on a second which together form the headwaters of the Styx River; McKechnie Creek crosses the south-east section toward Tobermory Lake. The sandy soils in the north-west section are a notable feature of the block. The lakes on the property comprise about 14 acres and the remaining 385 acres are almost evenly divided between open and wooded land. The north-west section of the block which lies along Highway No. 6 is particularly valuable as a potential demonstration area.

(13) Tobermory Lake

This 927 acres lies across hummocky and bouldery outlying strands of the Glenelg Gravelly Hills, intermingled with rougher phases of the eastern section of the Bentinck Whale-back Hills. The area is interlaced by an intricate system of valleys, many of which have steep erodible sides and poorly drained floors. The swamp margin surrounding Tobermory Lake extends into the north-west corner of the block. The area is classed as 490 acres now in some form of forest cover, 355 acres open and 81 acres as scrub land invaded by hawthorn, wild apple and sumach. The area has considerable value as a demonstration unit since it lies across an improved county road. (The western section of the area is adjacent to the 100-acre Dunsmore Tract



AREAS RECOMMENDED FOR THE
SAUGEEN AUTHORITY FOREST
HOLLAND, NORMANBY AND EGREMONT TOWNSHIPS
DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION SURVEY - 1951
RECOMMENDED AUTHORITY FOREST AREAS
EXISTING WOODLAND
SCRUB LAND
PLANTATION
SPRING
TOWNSHIP BOUNDARY
UPPER SAUGEEN WATERSHED BOUNDARY
SCALE - MILES
HOLLAND TWP
EUPHRASIA TWP
GLENELG TWP
BENTINCK TWP
NORMANBY TWP
EGREMONT TWP
PROTON TWP.
SULLIVAN TWP
BERKELEY
HOTFORD
GLASCOTT
HAMPDEN
VARNEY
DEMONSTRATION WOODLOT LOTS 1 AND 2
GREY COUNTY FOREST (PART OF MAIN TRACT)
KEY MAP
SHOWING PARTS OF TOWNSHIPS ON THIS PLATE
HOLLAND
EUPHRASIA
SULLIVAN
OSPREY
ARTEMESIA
GLENELG
BENTINCK
BRANT
NORMANBY
EGREMONT
PROTON
MELANCTHON

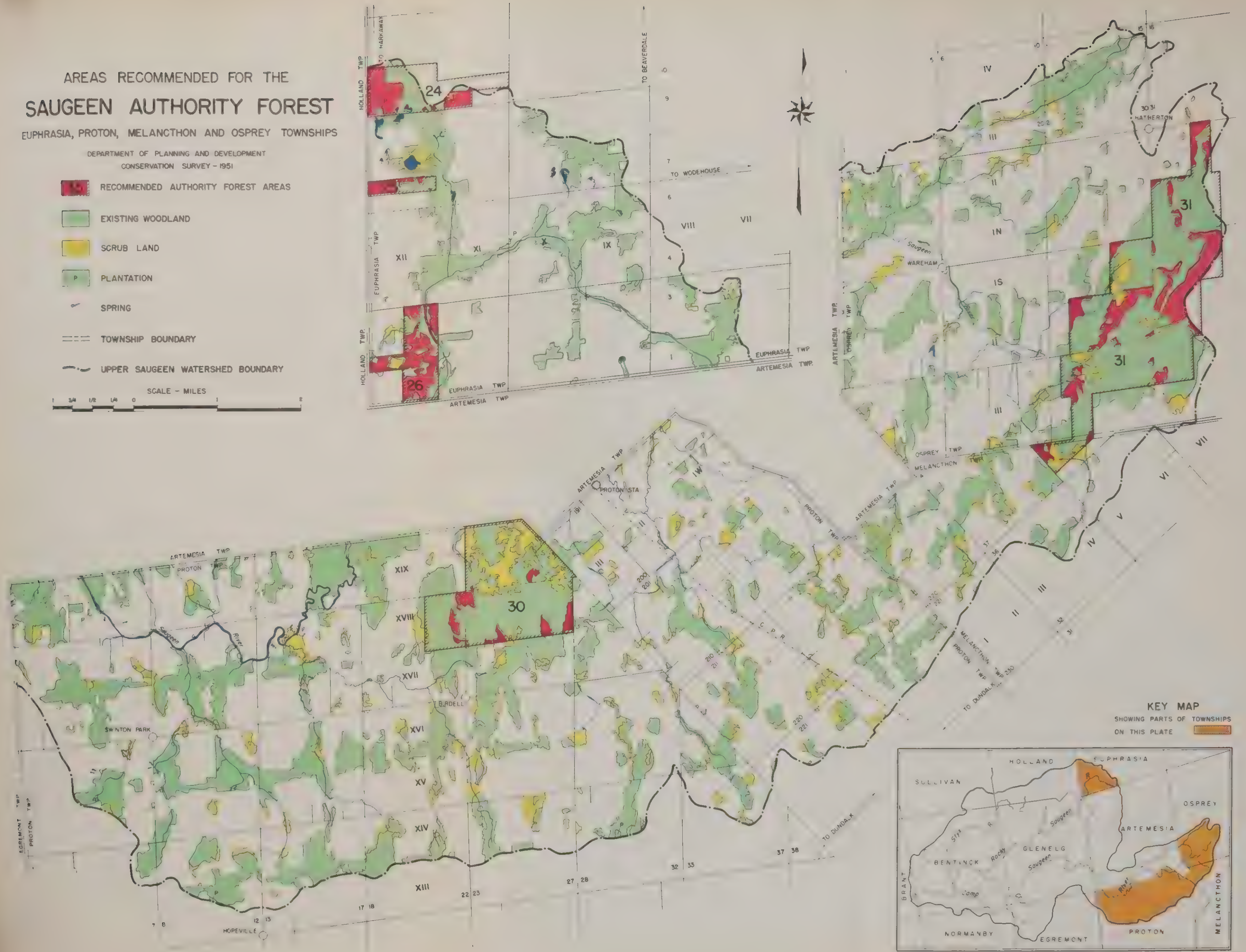
of the Grey County Forest, purchased in 1947 for an average of $6.00 per acre, while the south-eastern section borders the 200-acre Glenrodin Tract of the County Forest, half of which was purchased in 1946 at an average of $7.50 an acre while the other portion was acquired from the Crown in 1951 for $1.00 per acre.)

(14) Durham

Comprising 633 acres and lying across Highway No. 6 just south of Durham, this block has considerable value as a demonstration area. It is steep hummocky topography with sandy and gravelly soils in the main. The abandonment of most of the area for general agriculture indicates its economic value in this field, even though it is close to an urban area and well serviced by a highway. However, some pressure for expansion of the town of Durham is evident in the taking up of a few small holdings along the highway, and in the event of acquisition by the Authority certain parts of the strip of land along the highway should be held for subdivision. Most of the existing woodland on the property is cedar growth along the Wilder Lake tributary of Camp Creek, an excellent trout stream which winds across the area. Open land totals 458 acres, woodland 118 acres, while a small pond occupies about 5 acres and 52 acres is classed as scrub willow and hawthorn.

(15) West Varney

Only 158 acres in extent, this is one of the smallest areas suggested for acquisition by the Authority for forestry purposes. The area is a steep and stony section of the Durham Rolling Plain and contains a small part of the Camp Creek valley. About 84 acres is open land, 66 acres is wooded and the remaining 8 acres is wet scrub. The woodland is second growth, upland hardwoods, and swamp hardwoods and conifers, and includes about 15 acres which have been reforested. Two very small plantations were set out on steep slopes about 20 years ago and the remainder within the last five years.


AREAS RECOMMENDED FOR THE
SAUGEEN AUTHORITY FOREST
EUPHRASIA, PROTON, MELANCTHON AND OSPREY TOWNSHIPS
DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION SURVEY - 1951
RECOMMENDED AUTHORITY FOREST AREAS
EXISTING WOODLAND
SCRUB LAND
PLANTATION
SPRING
TOWNSHIP BOUNDARY
UPPER SAUGEEN WATERSHED BOUNDARY
SCALE - MILES
24
26
30
31
HOLLAND TWP
EUPHRASIA TWP
ARTEMESIA TWP
OSPREY TWP
MELANCTHON TWP
PROTON TWP
EGREMONT TWP
TO HARKAWAY
TO BEAVERDALE
TO WODEHOUSE
TO DUNDALK
WAREHAM
HATHERTON
PROTON STA
SWINTON PARK
HOPEVILLE
C.P.R.
KEY MAP
SHOWING PARTS OF TOWNSHIPS
ON THIS PLATE
HOLLAND
EUPHRASIA
SULLIVAN
OSPREY
ARTEMESIA
BENTINCK
GLENELG
BRANT
NORMANBY
EGREMONT
PROTON
MELANCTHON

(16) East Varney

The varied topography of this 280-acre section embraces strands of the Glenelg Gravelly Hills, a section of the Durham Rolling Plain and sandy and gravelly deposits. It is on the whole hummocky, stony land with serious erosion on many of the steep slopes. The 133 acres of existing woodland is mostly mixed wood swamp growth associated with a tributary of Camp Creek which traverses the block. The open land comprises about 147 acres.

(17) Tartan

Comprising only 152 acres, this is the smallest area recommended for acquisition by the Authority. The area is the typical hummocky and bouldery terrain of the Glenelg Gravelly Hills which here form a part of the divide between the Beatty and Main Saugeen Rivers. The area is classed as 123 acres open, 7 acres of willow scrub and 22 acres of woodland, most of which is severely culled beech and sugar maple.

(18) McWilliams Station

This area is an extensive tract of the very hummocky and bouldery Glenelg Gravelly Hills through which flow a number of tributaries of the Main Saugeen. (In 1938 the first parcel of land acquired for the Grey County Forest was purchased in this area, and since that time this has been expanded into the 940-acre Main Tract of that forest at an average purchase price of less than $5.50 per acre.) The area suggested for acquisition totals 1,519 acres of which 1,053 acres are open land and mostly rough pasture, 17 acres are hawthorn scrub and 449 acres, or 30 per cent, have some form of forest growth. The existing woodland is about half swamp cedar types and the remainder upland hardwoods which in several cases are valuable stands of saw timber. The area extending for 13 lot widths along Highway No. 4 would be a valuable demonstration unit. (A section of the area fronting the highway has been taken up as cottage sites because of attractive spring streams. It is probable that these

Hilly land of this type is best suited for reforestation. Many thousands of acres occur in Glenelg Township.

Poorly drained pasture becomes covered with scrub willow. Such areas should be fenced from cattle and planted, where possible.

owners, recognizing the advantages of extensive reforestation at the head regions of their trout streams, would agree to the sale of the backs of their lots if consideration is given by the Authority to the continuation of their fishing privileges.)

(19) Bunessan

This 400-acre area lies on a typical strand of the Glenelg Gravelly Hills. It is hummocky, stony and has steep-faced valleys. Open land totals about 300 acres, 39 acres are willow scrub and the remaining 131 acres are woodland. The low-land forest is cedar, tamarack and black ash swamps but most of the woodland is upland hard maple, beech, basswood, white ash and hemlock, much of which is timber of good sawlog size.

(20) Glenelg Centre

This is an extensive section of the Glenelg Gravelly Hills. The terrain is rough, steep hummocks which in the main have a very droughty gravelly soil and boulder piles and gravel pits are much in evidence. The Main Saugeen winds through the southern section of the area. Comprising 2,572 acres, the area is classed as 1,456 acres open, 1,043 acres wooded and 73 acres scrub land, most of which is hawthorn. Some parts have upland hardwood regeneration which would soon cover the areas if grazing were stopped. The existing woodland is typical of the area, second growth upland hardwoods dominated by hard maple and swamp lands dominated by white cedar, with a wide range of diameter classes. Like other areas adjacent to well travelled highways, this block has demonstration value to recommend it for early acquisition.

(21) Irish-Farden Lakes

This very rough section of the Glenelg Gravelly Hills is actually a continuation of the Glenelg Centre block and has much the same features as have all the areas on this same landscape type, which extend in a rough crescent from the Allan Park area south of Durham through the Wilder Lake - McWilliams Station - Glenelg Centre area to beyond Markdale

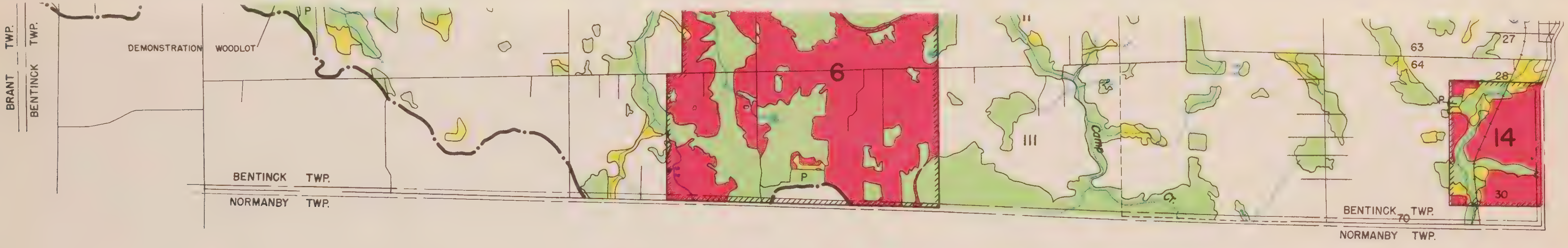
where the formation meets the Holland Ridge. The Irish-Farden Lakes section of this landscape type is interlaced with a series of swampy valley flats and kettles. The steep-sided valley of the Rocky Saugeen River, here displaying several well-marked terraces, cuts across the north-west section of the block. Two small lakes, Farden and Purley, are located in the area and Irish Lake forms a part of its eastern boundary. Open land in the block totals 1,878 acres and this is mostly now used as rough pasture. (It has a high drought hazard and a very low carrying capacity.) Lakes total 41 acres and 129 acres of willow and hawthorn scrub were mapped. The woodland, 2,609 acres in extent, is very similar in composition to that found in the Glenelg Centre block.

(22) Bells Lake

This block lies astride the swampy floor and steep-sided bouldery flanks of a deeply entrenched valley and includes a section of the Glenelg Gravelly Hills. Bells Lake, the largest in the watershed, covers about 215 acres of the 2,020-acre block. About 63 per cent or 1,271 acres of the area is now wooded. Most of this is on the valley floor which is almost entirely wooded with a dense swamp in which are found all the swamp species in the watershed. Upland hardwoods, sawlog size in some sections,occur on slopes flanking the valley and on the south-east hilly part of the area. The open land, 515 acres in extent, is mostly on the east flank of the valley and the south-east hilly area. It is to these lots with considerable open area that the attention of the Authority is drawn for reforestation work. The remainder of the area is included in the total for its water-regulating value.

(23) Walker Lake

This is a typical rough section of the Holland Ridge which here separates the North and Rocky Saugeen drainage basins. The area is classed as 599 acres of open land, 205 of woodland and 26 acres of water (Walker Lake and a 4-acre pond, neither of which has overland outlets). The woodland is mostly sugar maple and associated upland hardwood species.



AREAS RECOMMENDED FOR THE

SAUGEEN AUTHORITY FOREST

BENTINCK TOWNSHIP

DEPARTMENT OF PLANNING AND DEVELOPMENT - CONSERVATION SURVEY - 1951

35 RECOMMENDED AUTHORITY FOREST AREAS

EXISTING WOODLAND

SCRUB LAND

P PLANTATION

SPRING

TOWNSHIP BOUNDARY

UPPER SAUGEEN WATERSHED BOUNDARY

SCALE - MILES

1 3/4 1/2 1/4 0 1 2

KEY MAP

SHOWING PART OF TOWNSHIP ON THIS PLATE.

(24) Harkaway

Like other areas located on the Holland Ridge landscape type, this 450-acre section exhibits the common feature of hummocky, bouldery land. The open land, 188 acres in extent, is being used as rough pasture. The remainder of the area is classed as 254 acres of woodland, 6 acres in ponds and 2 acres of willow scrub. The woodland of the western section is sugar maple, beech and associated species, much of which is sawlog size, while the eastern section is very young growth of the same species in a recently cut-over area. A small plantation of Scotch pine was established on one of the lots about 10 years ago.

(25) Holland Gore

The 550 acres in this section are in four separate small areas; three are in a gore section of Holland Township (by which the group is named) and one is nearby in Euphrasia Township. The areas are on a section of the Glenelg Gravelly Hills where this landscape type butts against land of similar hummocky and stony nature, the Holland Ridge. Most of the open area of 309 acres is used as rough pasture. The remaining acreage is classed as 3 acres of water surface, 27 acres of marshy scrub land and 211 acres of woodland. Both upland hardwoods and swamp types occur, the swamp growth being found around several small boggy ponds which are in one of the headwater regions of the Bells Lake - Black's Creek drainage system.

(26) Markdale

The property recommended for acquisition here is irregularly shaped and is associated with several topographic features. A large section lies on the floor of the Rocky Saugeen valley and its steep and bouldery flanks and terraces, while strands of the Glenelg Gravelly Hills frequently occur toward the margins. The area totals 1,665 acres and of this cleared land comprises 834 acres, woodland 758 acres and scrubland 73 acres. Much of the area now wooded is valley bottom land

or other poorly drained areas and the growth is chiefly young coniferous or mixed wood species common to the wet sites of the watershed. The area has considerable value for demonstration purposes since it lies astride Highway No. 10 and an improved county road and is close to Markdale.

(27) East Priceville

Comprising 648 acres, this area straddles a section of the steep-sided valley of the Main Saugeen River and includes a rough and bouldery section of the Glenelg Gravelly Hills. The open land is 408 acres in extent while 40 acres is classed as scrub land, mainly willow, and 199 acres are now forested to some degree with both good upland hardwoods and swamp types present. Since Highway No. 6 forms one boundary of the property this is another section with significant demonstration value.

(28) South Priceville

This small 260-acre tract is typical terrain of the Glenelg Gravelly Hills landscape type. About 139 acres of the property are open land while 6 are willow scrub and 115 acres are wooded. Cedar and fir dominate the natural woodlands and about 12 acres of plantation have been set out within the last 10 years. (An improved pasture project established under the auspices of Grey County Crop Improvement Association as a demonstration has been underway for a number of years on an adjacent property.)

(29) Saugeen Junction

This area is named after the nearby railway junction point of the same name. It is associated with the northern margin of the extensive Dundalk Silty Plain and its junction with the poorly drained valley flats of the Main Saugeen. Only 49 acres of the total of 416 are classed as open, while 95 acres are willow and 272 acres are swamp woodland, which is chiefly poplar, birch, white elm, black ash, fir, cedar and tamarack. The area has been outlined to form a nucleus within the extensive swamp in this vicinity which the Authority may decide to manage.

(30) Proton Swamp

Comprising 1,320 acres, this is an extensive swampy area on a poorly drained section of the Dundalk Silty Plain. Of the total area, 870 acres are presently forested to some degree, 348 acres are wet-site woody shrubs such as willow, dogwood and alder, while only 102 acres are classed as open land. The wooded area is almost entirely swamp poplar and cedar growth which varies over the area in density, size and admixture of other swamp species. In many locations throughout the extensive area of wet-site woody shrubs the shrub growth is giving way slowly to the establishment of commercial forest species. The swamp is one of major significance as a natural water storage area. (Part of an area designated as a Crown Game Preserve is included in this block.)

(31) Osprey Swamp

Like the preceding area, this is a large swamp on a poorly drained section of the Dundalk Silty Plain. The area outlined on the map is only a part of this extensive swamp which lies across the drainage divide of three major rivers of South-western Ontario, the Saugeen, Grand and Nottawasaga Rivers. Comprising 2,347 acres, the present state of the area is classed as 1,667 acres wooded, 186 acres of wet-site shrubs, 283 acres open and 211 acres. The tree growth of the area is very similar to that of the Saugeen Junction and Proton Swamps just described. The reports of early land surveyors in Ontario describe the vegetative cover at the time and a study of such records is of considerable value in interpreting present-day conditions and suggesting plans for the future. Gibson, reporting his laying out of the Durham Road in Osprey Township in 1848-49, describes the Osprey Swamp as follows:*

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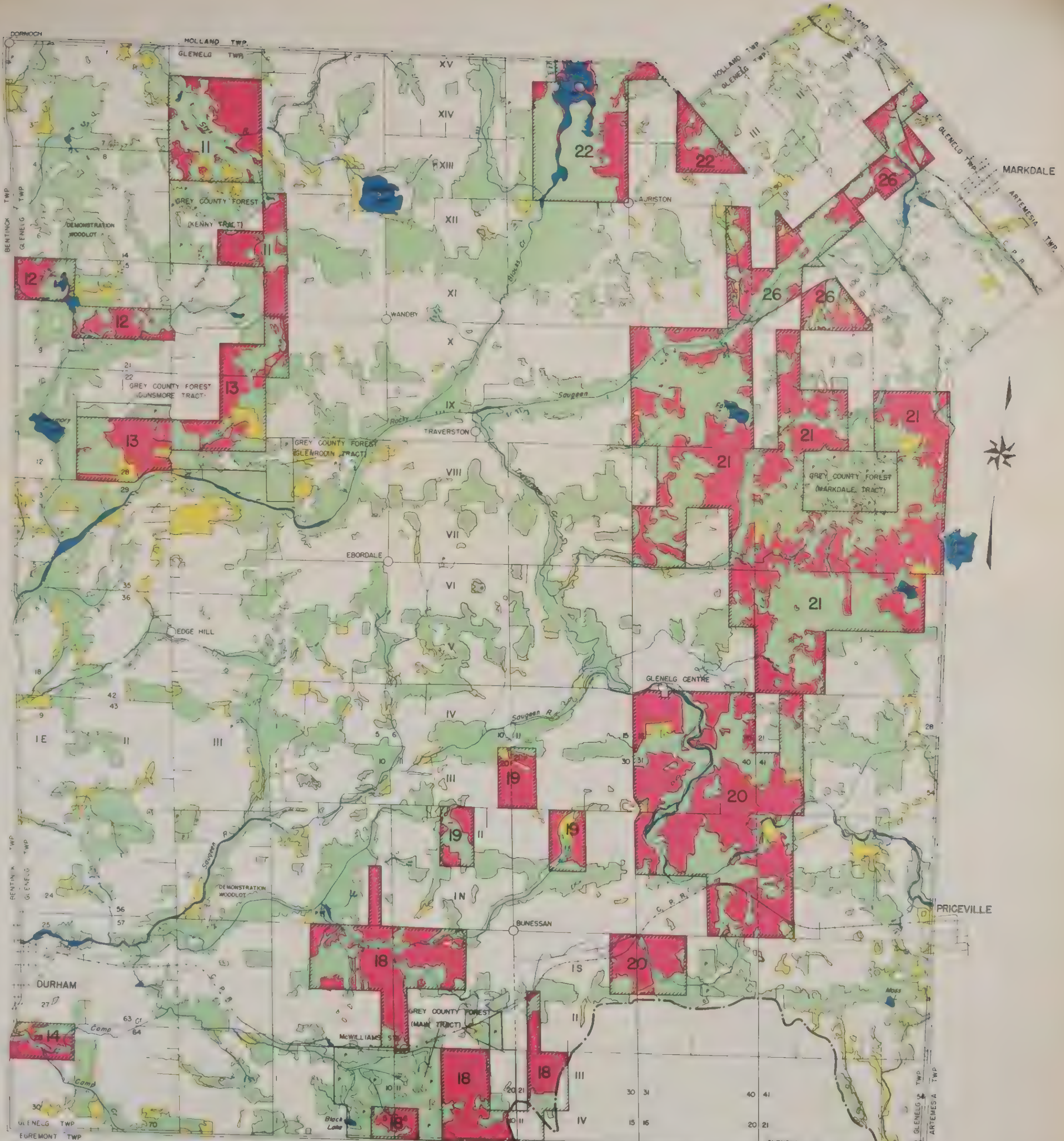
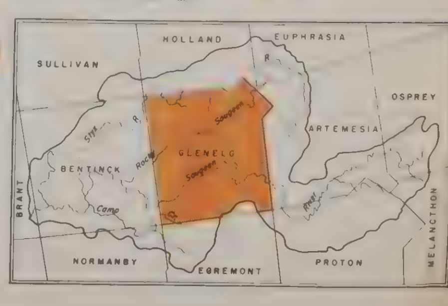
* Gibson, David. Report of Survey of Durham Road in Osprey Twp. Ontario Department of Lands and Forests, Survey Notebook No. 738.





AREAS RECOMMENDED FOR THE

SAUGEEN AUTHORITY FOREST

GLENELG TOWNSHIP

DEPARTMENT OF PLANNING AND DEVELOPMENT – CONSERVATION SURVEY – 1961

RECOMMENDED AUTHORITY FOREST AREAS

EXISTING WOODLAND

SCRUB LAND

PLANTATION

SPRING

TOWNSHIP BOUNDARY

UPPER SAUGEEN WATERSHED BOUNDARY

SCALE – MILES

KEY MAP

SHOWING PART OF TOWNSHIP ON THIS PLATE

"The timber in the swamps is chiefly cedar, spruce and tamarack, at the outsides the timber is heavy, and towards the center it is light and thin unfit for any agricultural purpose. In the thin places the cranberry is found. Near the outsides, the huckleberry, strawberry and black currant.

"The moss on the ground is close and compact,... a pole can be pushed down two or three feet in the decayed vegetable matter."

The change in the vegetative cover across the swamp is very similar today to that described by Gibson over one hundred years ago. There is probably a greater occurrence of poplar now because of openings created by cutting in the earlier stands. This area is recommended for consideration by the Authority for its influence on stream flow but when managed for this purpose, direct financial returns from tree growth should of course be a part of the program.

4. Controlled Woodlot Management

Before the necessary conservation measures on that part of the watershed exclusive of the proposed Saugeen Forest can be properly co-ordinated, some system of controlled cutting of privately owned woodlots must be established. The reason for this is that the average owner does not take a broad view of the value of forest cover and is not interested to any great extent in what may happen to land or stream flow off his property. The result is that throughout the watershed there is a systematic cutting of woodlots for the purposes of lumber and firewood. The type of cutting has been in progress for many years, and the portable sawmill has done a great deal of damage in removing, particularly, young, thrifty trees. The system of selling acre or half-acre blocks of timber for fuelwood is also another vicious practice, for the reason that when a purchaser buys such a block, in nearly every case he clean-cuts every tree which can be used, down to the minimum diameter limit. Some system of regulating cutting would correct this situation and certainly the areas which are connected in any way with the headwaters of streams, or the feeding of springs, should be controlled to the extent that they cannot be clean-cut.

Where conditions warrant, cutting would be continued, but should be controlled by agreement with the Authority and only such trees as are marked by a competent person should be cut. Provision should be made for restocking, where necessary, the intention being to interfere as little as possible with the economy of farm property where the supply of wood is concerned. County by-laws restricting cutting passed under the Trees Act do not prevent an owner from clear-cutting any area if the wood is for his own use.

For many years now conservationists have advocated controlled cutting of woodlots. In some sections, particularly in tobacco-growing counties such as Norfolk County, the destruction of woodlots for the curing of tobacco has become alarming. It is admitted that the question requires delicate handling, but where the good of the whole community is envisaged some middle road of agreement could be arrived at. Furthermore, the distribution of free trees by the government for conservation purposes is sometimes criticized, and rightly so, where on one farm the owner plants an area with seedlings and in the same year his neighbour clean-cuts a woodlot which perhaps protects the headwaters of a stream. In fact, so distorted is the relative value of plantations versus established woodlots in the minds of some people that there are examples on record where municipalities have purchased land for reforestation and have allowed the owner to cut the timber before giving title.

It is admitted, of course, that there are extenuating circumstances when a farmer may consider it necessary to raise money by selling timber. This in itself is not so serious if the cutting is done in such a way that the benefits of the forest are retained. Young forests, as well as old, protect the soil and have water-regulating value.

The basis on which a regulation of this kind should be carried out is a consideration of the woodlot concerned. To make a blanket ruling that all woodlots on the Thames should not be cut, or should come under one type of control measure, would not work to the best advantage of the

community and certainly would not be in the interests of good forestry.

Some woodlots have reached the stage at which they are worn out and if the land is good should be cleared off and cropped. Others may be composed of a high percentage of worthless species and have no relation to water regulation in the countryside, and likewise could be disposed of to advantage. But where the woodland has a direct bearing on water regulation, erosion, retarding of the wind and similar benefits, the desire of the individual should be sacrificed for the good of the community. The whole question, therefore, resolves itself into an examination of each woodlot by a competent person, and the prescribing of a program of management to suit each case.

5. Woodland Grazing

> "The most widespread abuse of forests is that of utilizing them as pasturage for animals. If this practice alone could be eliminated more than half the battle to save Ontario woodlots would be won. Forestry and pasturage cannot succeed on the same piece of ground, as diametrically opposite conditions are necessary for each."

> "It is foolish to consider replanting millions of acres to forests unless the owners of millions of acres already under forest are convinced of the necessity and economy of caring for them in such a manner that they will be perpetuated and improved."

The preceding quotations are from the Report of the Ontario Royal Commission on Forestry, 1947, in the section dealing with forestry on private lands. They do not present new themes, for as early as 1908 the problem was formally recognized in Ontario by legislation in the Exemption of Woodland from Taxation Act. This Act, which includes a "no grazing" clause, exempts from taxation one acre in ten used for forestry purposes. It is generally admitted that the Act, in offering to the woodland owner a very slight saving in taxes, has done little for woodland conservation. Additional recognition of the problem was accorded in the same year by inauguration of the policy of establishing Provincial Forest Stations centrally in

Cattle have destroyed all reproduction and most of the forest duff in this woodlot. This, combined with compaction of the soil, is beginning to kill the large trees.

Fire is only a serious menace in cedar swamps, but here it can do great damage. With the increase in the area of plantations of solftwood trees the risk is constantly increasing and a small but efficient fire protective system should be established.

extensive areas of submarginal lands. The first such station, St. Williams, in Norfolk County, was located to function as a forest nursery to supply seedlings to reforest submarginal lands. Since this program began several hundred million trees have been distributed by the Government, entailing an investment of millions of dollars. Meanwhile, after 40 years of a reforestation program designed to retire submarginal lands to their most economic use, the destruction of existing woodlands on the same type of lands by domestic grazing has continued at an alarming rate. It is estimated that over the agricultural part of Southern Ontario close to 70 per cent of woodlands are grazed to some extent.

In the Upper Saugeen area the survey of all the woodland showed that about 43 per cent was grazed. This percentage is more favourable than is the case for many other watersheds in Southern Ontario, but this fact should offer no self-satisfaction to those interested in conservation in the area. In this report thousands of acres are recommended for reforestation, both by the Authority and by private owners. It is indeed illogical to reforest one area while the woodland on the adjacent lot is being destroyed by grazing.

1. Why Woodlands are Grazed

The following is taken from The Farm Woodlot*:

"What are the reasons for the widespread practice of allowing stock in the woodlot?

1. Past Practice The woodlot has always been considered a pasture field and the stock helped the pioneer to clear the land.

2. Pasture The value of woodland pasture is low compared to cleared land, because grass grown in the shade is not nearly as high in food value as that grown in full sunlight. The following statement in respect to woodland pasture has been made by leaders in agriculture: 'On the whole, the opinion of the Agronomists is that, on the average, woodland pasture will produce about one-sixth the quantity of pasturage, and the quality will be about one-half as good as that of the improved pasture.' Weeds are usually prolific in wooded pastures, often smothering most of the grass.

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* The Farm Woodlot (reprinted 1947). Ontario Department of Lands and Forests, Reforestation Bulletin No. 2.

3. Shade for the Stock If this is desired, leave a small portion of the woodland in the pasture when fencing the woodlot.

4. Springs of Streams in the Woods that Supply Water for the Stock

This may be made accessible in the same manner as the provision for shade.

5. Some Owners Prefer a Woodlot without Saplings, because they interfere with the cutting of trees and the gathering of sap.

6. Ignorance Many do not realize that stock injure a woodlot.

7. Selfishness Some say, and others by their actions imply, 'There is enough wood for me, why should I concern myself with the needs of future generations?'"

2. Why Woodlots Should Not Be Grazed

The number of cattle permitted to graze and the size of the woodlot have a direct relationship to the damage which is done. A large woodlot of course is not as seriously damaged by a few head of cattle as a small one. However, in most cases where grazing is permitted over a number of seasons the damage is serious.

Livestock admitted to woodland browse on the leaves and shoots of small trees and ride them down, and by scuffing the surface roots of larger trees injure them and permit entry of fungous diseases.

Field observations indicate that cattle have preference habits in grazing woodlands. Unfortunately this preference is for the more economically desirable species such as maple, basswood, elm and beech, whereas undesirable species such as hornbeam, blue beech, dogwood and hawthorn are grazed only when cattle are seriously underfed. Coniferous species are rarely browsed. This combination of factors, under continued grazing, changes not only the quantity but the quality of the reproduction and so the succeeding stand. The poorer hardwood species, and conifers where these occur, are favoured. The invasion of pastures by cedar and hawthorn is an illustration of this grazing preference.

Continued overgrazing affects natural reproduction both directly and indirectly; directly in so far as it affects the reproduction itself and indirectly through its effect on the soil. Livestock trampling compacts the soil, breaks up the protective layer of litter, exposing the mineral soil to drying, and the cattle, by consuming the vegetation within reach, reduce the volume of litter naturally returned to the soil. It is this litter which keeps the soil open or porous and in a highly absorptive state. Thus water relations are changed, which adversely affects the rate of tree growth and may early eliminate seedlings which manage to make a start in the compacted soil.

A woodland is doomed where conditions persist which will not permit natural regeneration. After a time with no new growth to replace larger trees which die of natural causes, the canopy begins to open up, and sunlight let in further dries out the soil. Weeds and later grasses which require plenty of light gain a foothold and a sod begins to form. In general tree seeds which germinate cannot compete with an established grass cover. As these effects of grazing progress the stand becomes open or park-like and eventually all the trees disappear.

Livestock grazing affects more than the growth of trees on the owner's land. Soil erosion in the woodland increases as the absorptive capacity and mechanical protection afforded the soil by the litter is reduced. The opened canopy exposes the soil to the erosive force of rain impact and a compacted soil forces overland movement of water. Livestock tend to follow trails in the woodland and these often become centres of serious erosion. Thus continued grazing increases surface run-off and soil erosion.

Soil losses and the amount of water which ran off the land were measured at the Soil Conservation Experiment

Station, La Crosse, Wisconsin. The table* shows the results of six years of measurements on three separate watersheds having the same soil type.

	Run-Off		Soil Loss
	Inches	% of Total Precipitation	(Lbs. per Acre)
Watershed A (Grazed Woods)	2.31	1.17	2,126
Watershed B (Protected Woods)	.05	.02	19
Watershed C (Open Pasture)	.79	.40	866

Watershed A:	2.67 acres of second growth hardwoods. Slope 15-18 per cent. Grazed to optimum carrying capacity.
Watershed B:	11.5 acres of second growth hardwoods. Slope 25-50 per cent. Neither grazed nor burned.
Watershed C:	5.85 acres cleared of second growth timber in 1932. Slope 25-35 per cent. Grazed to optimum carrying capacity.

3. The Fundamental Problem

Basically the problem in grazing, in fact in all woodlot forestry, is that a tree takes not one or two seasons but generally more than the lifespan of a man before it is ready for harvest. This makes the proof of woodland economics complicated and possibly beyond the understanding of many owners. It can be shown that in the long run the husbanding of the woodlot or submarginal land will return more dollars than the forage value which it may produce for livestock.

4. The Economics of Woodland Grazing

Some examples of the economic fallacy of grazing woodlands are given.

(a)** The Wisconsin Agriculture Experiment Station measured the total yield per acre of dry matter from three types of pasture over a 5-year period in Richland County:

* Soil Conservation Service, U.S. Department of Agriculture. Forestry Handbook (Fourth Edition). 1948. Upper Mississippi Region. Compiled and edited by S.S. Locke, Chief, Regional Forestry Division.

** (The Case Against Cows.) Wisconsin Conservation Bulletin, December 1951.

Improved pasture (grass and legume)	3,210 lbs.
Unimproved open pasture	1,453 lbs.
Woodland pasture	276 lbs.

Here the improvement of one acre of open pasture provided a gain of 1,757 pounds of feed which is equivalent to the forage from 6.4 acres of woodland producing at the rate of 276 pounds per acre. In this case the improvement of about 6½ acres of existing open pasture would provide all the additional roughage that could be obtained from 40 acres of woodland.

(b)* In Minnesota and Ohio a study of the grazing capacity of various types of pasture determined the protein and carbohydrate yield of the forage and the results are given in the following table. The figures are for a 6-month grazing season.

Number of Acres Required per Cow on Various Pastures

Kind of Pasture	Acres per Cow
Dense woods pasture	9 plus
Average woods pasture	4.5 to 9.0
Open woods pasture	3.0 to 4.5
Steep open pasture	2.3 to 3.6
Rolling land pasture	1.4 to 2.3
Bottom land pasture	1.1 to 1.4
Improved or legume pasture	.75 to 1.4

(Over Ontario the average allotted pasturage per animal unit for the grazing season is said to be 4 to 5 acres.)

(c)* The U.S. Soil Conservation Service co-operating with the Wisconsin Agriculture Experiment Station conducted studies which showed that the daily pasture cost per cow was greater in woodland pastures. Taxes and other charges against the land, fencing, costs of establishment and acres required per cow were all considered. The study showed the relative

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* Soil Conservation Service, U.S. Department of Agriculture. Forestry Handbook (Fourth Edition). 1948. Upper Mississippi Region. Compiled and edited by S.S. Locke, Chief, Regional Forestry Division.

daily pasture costs per cow on different classes of pasture to be approximately as follows:

Rotation pasture	5¢
Open permanent pasture	6¢
Improved pasture	5¢
Wooded pasture	17¢

At this rate, for a 180-day grazing season, woodland pasture cost $30.60 per cow, whereas on improved pasture the cost was $9.00. In other words, wooded pasture cost over three times as much as improved pasture.

(d)* In Ohio an ungrazed woodland adjacent and similar to a grazed woodland yielded a gross income from maple syrup production of $10.43 per acre per year greater than the grazed woods over a 5-year period (Damback, 1944).

(e) A fully timbered average maple stand, 60 years old, may yield about 4,000 board feet of saw timber per acre, net scale in the Saugeen area. Such a woodlot is virtually ruined by 20 years of heavy grazing, whereas 20 years of protection and no logging may increase the net volume to approximately 8,500 board feet per acre. The gain of 4,500 board feet is equivalent to an annual increase of 225 board feet per acre. At $28 per thousand on the stump this amounts to a mean annual gross income of $6.30 per acre over the period by utilizing only the increase in volume.

5. The Right of Public Concern in Woodland Grazing

Continued woodland grazing is more than the private affair of the property owner. It becomes even more than a community interest because anything which contributes to soil loss and to increased surface run-off lowers the yield capacity of the land on the one hand and on the other adds to the flood hazard. Woodland grazing lessens the volume and value of forest products which reach the market and this influences all the economy dependent upon such supplies. In these respects woodland grazing becomes a prime concern of the Conservation

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* Westveld, R.H. and Peck, R.H. Forestry in Farm Management - Second Edition, revised. 1951.

Authority. It is far cheaper to maintain or restore natural existing woodlands than it is to create new forest areas artificially.

6. The Approach to the Problem

It is suggested that the policy of the Authority be education against woodland grazing by showing that it constitutes an actual loss in dollars and cents. Some of the preceding text points out that the farmer loses money by grazing his woodland and that he probably does not realize this. Of course it remains the choice of the farmer whether his plan for the farm will include a woodlot - but most farmers are open to sound suggestions on how to make a better living at farming. It should be recognized that the woodland is a forestry problem on the farm and that close liaison between woodland and agricultural specialists is required.

Thus it is necessary to show the farmer that the annual contribution of managed woodland to his economy can be significant and can far outweigh annual woodland forage value. At the same time it should be shown that it costs more per cow to carry stock on poor pasture than on good pasture and that the best way to obtain forage equivalent to that lost in fencing woodlands is to improve existing open pasture.

The Authority will find very little local or regional data on woodlands to prove their arguments on economic return, and the Authority should recommend that the appropriate authorities extend their studies in this field. However, the Authority may expect invaluable assistance to be willingly given in this field by local wood-using industries. Some of these have been located in the area for decades and are dependent on continued supply from local woodlands.

It has been suggested from different quarters that the fencing of woodlands is expensive and that part of such expense should be borne by the Authority. Such a program is under way in Halton County and may appeal to the Saugeen Authority. However, it may be strongly argued that this is in effect subsidizing the production of livestock since it is the livestock which create the need for fences.

7. Diameter Limits

The basic method of control usually advocated is cutting to a diameter limit; that is, that all trees below a certain diameter - for example, ten inches - should not be cut. Such a regulation may or may not be good forestry. In most cases it would not be because there would be much worthless material below this diameter limit, such as poplar, thorn, willow and other species, which should be taken out. At the same time there would be certain large trees above the diameter limit which should be left for the benefit of the forest, as well as trees suitable for reseeding the area. The diameter limit should not be a fixed rule but simply a guiding principle; a sort of yardstick on which the landowner can base his calculations. In an area the size of the Saugeen Watershed a program of individual woodlot examination should not be too heavy a burden on the Conservation Authority.

Nineteen counties, including the three covering the Saugeen Watershed, have passed by-laws under The Trees Act (R.S.O. 1950 c. 399) which empowers a county council to pass by-laws restricting and regulating the cutting of trees. In each case the by-law has fixed minimum diameter limits below which trees may not be cut except in special circumstances. The object of this is to prevent the cutting of trees at the time when they are putting on their greatest diameter growth. These limits are usually 5 or 6 inches for white cedar, red cedar and black locust and range from 10 inches to 16 inches in the various counties for all other species. The limits which have been set are actually far too low for the final crop trees as most trees are making their maximum diameter growth after they reach 18 inches in diameter, but it is an elementary step in the right direction. Every county should have restrictions of this type and it is recommended that similar powers be extended to Conservation Authorities as a means of protecting existing woodland on their watersheds.

This woodlot was cut subsequently to the passing of the by-law. Some fair-sized trees remain and young growth is filling in the stand.

This area was clear-cut before the diameter limit by-law was passed in Grey County and a dense cover of weeds has grown up.

The jack pine sawfly is defoliating and killing these trees. Spraying would stop the infestation.

8. Forest Fire Protection in Southern Ontario

The task of protecting woodlands from fire in Southern Ontario presents a very different problem, or rather series of problems, from those of Northern Ontario, and consequently must be handled in a somewhat different manner. Though fire is a serious question on the Saugeen Watershed only in certain areas such as large swamps, it is a question to which some attention should be given.

Northern Ontario is predominantly forest land, the population is sparse, parties travelling through the forested areas are fairly readily accounted for by means of a permit system during the fire season, and watch is maintained for fire by means of look-out towers and air patrol.

In Southern Ontario south of the Canadian Shield the land is normally potential agricultural land with the woodland surviving in isolated patches as farm woodlots or in larger more or less continuous blocks of swamp or sand up to ten thousand acres in extent. The population is, relatively speaking, fairly dense, no part of any woodland is more than two miles from the nearest human habitation and most roads are travelled by a comparatively large number of people.

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is. Though he may know that young growth and small trees are burned by surface fires he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wounds may be completely healed, the damage shows up as defects when the tree is cut for lumber.

Many landowners in Southern Ontario are so completely unaware of, or indifferent to, the damaging effects of fire that they deliberately set fire in peat land to burn off the peat, starting fires which it is next to impossible to extinguish. Such fires burn for months, even under the snow, destroying many acres of woodland every year, not only on the land of the person setting the fire but frequently spreading over land adjacent to it.

The first step in fire control is fire prevention, and the best assurance of prevention is an enlightened **public opinion** which will make every member of the rural community conscious of the seriousness of the fire damage and of his duty as a citizen to do all he can to prevent it. The farmer can prevent most fires in farm woodlots if he exercises the same care that he does around his home and buildings.

Experience in the United States has shown that the most effective fire protective systems in rural districts are those set up under a state organization with local wardens appointed by the state forester on the recommendation of the local town* councils. In the rural parts of the State of Maine each town appoints its own fire wardens who handle fire protection in the town quite independently of other towns. This means there is a lack of co-operation between towns, wardens receive little practical training, organization is loose, and as wardens hold office at the pleasure of the town council there is a serious lack of continuity in administration.

In New Hampshire and Vermont wardens are appointed by the state forester on the recommendation of the council and in Vermont they serve until they resign or are removed for cause by the state forester.

Mr. H.H. Chapman, writing in the Journal of Forestry, states**: "It is not unreasonable to conclude that

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* The "town" in the Eastern United States corresponds closely to the township in Canada.

** Journal of Forestry, Vol. 47, No. 2, 1949.

the ratio of 34 to 1 in damage per acre of woodland between these two states (Maine and New Hampshire) is the direct consequence of Maine's failure to depart from the 'fire bucket' principle of town organization".

From the evidence collected in the northern states of the United States, where conditions most nearly approximate those of rural Southern Ontario, it is apparent that the most effective fire protective systems are those set up under the following conditions:

(a) Where the system is organized under the direction and control of the state of forester and the wardens in each town are appointed by him on the recommendation of the local council.

(b) Where wardens paid an annual retainer are actual residents in the locality. Usually they are farmers who have had practical instruction in fighting fire. They have the power to call out other local residents to help in firefighting and maintain a store of firefighting tools on their premises.

(c) Where the warden is assisted in his work by all members of the community. That is, his address and telephone number are known to everyone and fires are reported to him immediately.

(d) Where designated members of the community know that they are likely to be called on to fight fire and are paid so much per hour for the time they are so employed.

(e) Where every resident is thoroughly fire-conscious and realizes that loss of timber by fire is a loss to the whole community, and considers it his duty to prevent, report and fight fire.

(f) Where fires for burning brush and rubbish may be set only after a permit has been obtained from the local firewarden.

CHAPTER 6

FOREST INSECTS AND DISEASES

1. Forest Insects

In any project, such as that proposed for the Saugeen Watershed, careful consideration should be given to the prevention of insect outbreaks and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the course insects may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

It is important to avoid the planting of large areas of one kind of tree, otherwise conditions will be ideal for an outbreak of abnormal numbers of some insects which prefer the food afforded by that particular host. It is preferable to plant in blocks, the blocks distributed so that trees of one species are separated by blocks of different tree species. This tends to keep outbreaks localized until natural agencies bring them under control and facilitates direct control measures if such become necessary.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to insect attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects which may become excessively abundant and attack healthy adjacent trees.

Care should be exercised to prevent ground fires. Even light ground fires are frequently followed by severe outbreaks of bark-beetles and wood-boring insects.

Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may become reservoirs of infestations.

It is essential that surveys for insect conditions be made each year so that any abnormal increase in insect populations may be noted and control operations initiated before they develop to outbreak proportions. Serious and widespread outbreaks are frequently prevented by prompt and well-timed spraying operations over a comparatively small area. It is therefore necessary that spraying equipment be available and that laneways be maintained within the plantations for spraying purposes. Outbreaks of an extensive nature can generally be brought under effective control by strip spraying. In this method, alternate strips of trees in large plantations are sprayed, thus reducing the initial infestation and at the same time causing the native parasites to concentrate and build up in the unsprayed portions. This reduces spraying operations and the number of lanes required for the passage of spraying equipment.

Owing to the danger of injury by the white pine weevil, white pine should not be planted in pure stands unless the stands are very densely stocked in a good site. It is better to grow white pine in mixture with some immune species such as the better hardwoods. The protecting species should be taller than the white pine, at least in the early years.

In conclusion, it should be recognized that protection against leaf-feeding insects is very desirable since defoliation of a tree weakens it and thus makes it more susceptible to attack by bark-beetles and wood-boring insects as well as by organisms which do not usually attack healthy trees but which will hasten the death of weakened trees. Leaf-feeding insects alone may kill a thrifty, broad-leaved deciduous tree by completely defoliating it for three years in succession. Conifers, however, are usually killed as a result of one complete defoliation.

2. Tree Diseases

Productive woodlands require protection against fire, trespass, grazing animals and rodents, insects and disease. Protection is a part of forest management, and under a policy of sustained yield will be maintained in continuity. Good forest management is reflected in the health of the woods and, conversely, damage on account of disease is often a sign of mismanagement or neglect. In general, an objective of maximum yield, with attendant intensive silviculture, is compatible with, and often facilitates, protection and disease control.

For the purpose of discussing their pathology and protection, the hardwoods may be considered separately from pine in natural stands or plantations. The chief diseases of the hardwoods are the various trunk, butt and root rots, and chronic stem cankers, which are all endemic and may cause serious damage under aggravating conditions. Woodlots on the Saugeen Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings, designed to improve the composition and structure of the stands. Having established a sanitary condition, normal care should maintain it and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. In hardwood sprouts the stem may be infected from the parent stump. In older trees infection is chiefly through wounds, either of the root or trunk, which may be caused by fire, trampling by animals, insects, meteorological agencies, or by

carelessness or accident in felling and other woods operations.

Hardwoods are commonly cut selectively and not infrequently in clear fellings. Few foresters will approve the latter system, which is in fact often intended as a liquidation of the property. A system based on yearly selection, or frequent periodic return to conveniently planned subdivisions, has obvious advantages for small woods, and is well adapted to the control of decay.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut. While favouring the valuable species, those sprouts which, on account of decay hazard, are of undesirable origin should be eliminated. Such will comprise sprouts from the larger stumps and those from above-ground position.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered and so far as possible those which have become a poor risk through injury or other circumstances.

White pine is found in young plantations and in natural stands, almost pure or mixed with hardwoods. From the latter stands it tends to disappear on account of hardwood competition, except on sites which are particularly favourable for its reproduction. The white pine blister rust, which with the well known shoot weevil is a principal enemy of the species, is a factor contributing towards the elimination of seedlings and young trees.

White pine should be encouraged on those sites which are naturally suited to its reproduction so that fairly compact growth may be secured, thereby facilitating the protection problem. It is an important and valuable species in Southern Ontario, and its cultivation should be promoted by the institution of effective blister rust control facilities.

CHAPTER 7

LAND ACQUISITION

The problem of land acquisition in any part of agricultural Ontario, where practically all the land is privately owned, is one which requires careful approach. The ownership and use of land, especially for agricultural purposes, is considered by most citizens as one of their few remaining inalienable rights. However, where the good of the whole community is under consideration, such personal rights should be, and have been, overruled under the principle of eminent domain. Examples of such cases are the building of highways, the construction of power lines, and the acquiring of land for military purposes in the event of a national emergency.

In Southern Ontario compulsion has not been exercised to any great extent by the Government in planning proper land use schemes. But the facts of the past indicate that extensive areas of poor land will continue to be a liability to the community by virtue of low economic return as long as they are left in the hands of the individual. Evidently a more permanent authority which can effect long-range plans is required to bring such areas back to the use which is most beneficial to the community.

However, in dealing with land acquisition it should not be the desire of any authority to approach the problem in a dictatorial manner. It will require careful handling, and as a preliminary step in such work the people of the area should be acquainted with the purpose of the scheme, its ultimate benefits to the community, and by explanation and demonstration be gradually brought to the point where they will be glad to co-operate.

The only part of the Saugeen where large-scale transfers of property from private ownership to a forest

authority would have to be made are those areas which are recommended as reforestation areas in the preceding chapter.

It is true, of course, that isolated pockets of cleared land suitable for agriculture will occur in large blocks of land recommended for an Authority forest on a lot basis. However, it is not essential that these be withdrawn entirely from agriculture. An arrangement could be arrived at so that such areas could be incorporated into the forest as farm land and be used by forest workers for this purpose, one supplementing the other at different seasons of the year.

1. Methods of Acquiring Land

There are several ways in which land can be acquired and controlled for conservation purposes. These are enumerated and briefly discussed in this section.

(a) Transfer by Private Sale

The most satisfactory method of acquiring land is by private sale between the Conservation Authority concerned and the landowner. This method has been followed by the counties of Ontario in purchasing land for reforestation work in building up the system of county forests, which totals in round figures 90,000 acres. This method has its drawbacks, however, as individuals who have not the community's welfare at heart, or for one reason or another have an exaggerated idea of the value of their property, may block the completion of a unified area by refusing to sell. This was overcome in the State of New York, which has purchased over 450,000 acres of land for reforestation, by refusing to buy indivudual parcels of land unless there was a sufficient number in a group to make a contiguous block of 500 acres.

(b) Maximum Price per Acre

Another method which has been used has been to fix a maximum price per acre for this class of land, beyond which the forest authority is prohibited to go, allowance being made for the presence of good fencing and buildings on

the properties, which in some cases have been removed by the vendors and allowed as part payment for the land.

(c) Agreements

Where owners of property prefer to retain their woodlots, or where parts of farms fall within the forest area prescribed, and providing the retaining of ownership does not jeopardize the complete conservation scheme, agreements could be made for the control and management of such areas.

This method has been adopted by the Dominion Forest Service in Nova Scotia, where it has been desirable to control wooded areas for experimental and conservation schemes, and in this particular case the agreements cover a period of twenty years.

In Ontario there is one example, at least, where a municipality leased a part of a farm for reforestation work for fifty years, and one United Counties' council has adopted the plan of taking easements on land for the same purpose.

(d) Control by Existing Legislation

Under the authority of the Private Forest Reserves Act (R.S.O. 1950, Chapter 288), the Minister of Lands and Forests, on recommendation to the Lieutenant-Governor in Council, may, with the consent of the owner of any land covered with forest or suitable for reforestation, declare such an area to be a private forest reserve. When such an arrangement is made the Minister or his representative may reforest such areas, supervise the improving and cutting, and prohibit the removal of trees by the owner without his consent, and also prohibit the grazing of the area by cattle.

(e) Life Lease

Many of the farms on the proposed forest, as already mentioned, are of low agricultural worth and are supporting families at the present time. The problem in such cases is not so much the purchase of the property as what will become of the family after the farm is acquired. In almost every case it would be impossible for the vendor to purchase another farm with the money he receives, except one which is

of approximately the same value outside the forest. In some cases such farms are occupied by older people, whose families have grown up and left the community. The removal of these from their properties might work undue hardship on them, and in fact in some cases they might become a burden on the municipality. With some of these the plan of giving the vendor a life lease would be sufficient. In most cases such old people make little attempt at farming the whole property, but require only sufficient pasture for a cow or two, enough land for a garden, the house and buildings, and a supply of fuelwood. The plan of giving a life lease has been adopted in the case of two properties*, at least, on the county forests in Ontario, and has proved satisfactory to both contracting parties.

The areas which have been abandoned as farmsteads are shown on the Farm Classification map, to which reference is made in the previous chapter. The number of people living on lots recommended for acquisition was determined from the assessment rolls for Glenelg Township. About 48 per cent of the area to be acquired is in Glenelg Township and the facts of this investigation, which are summarized below, reveal fairly well this situation over all the acquisition area in the watershed. They illustrate that the displacement of families need not be a serious problem if unoccupied areas are acquired in the first part of the program.

Glenelg acquisition areas	-	14,028 acres
Number of holdings	-	162 (average 87 acres)
Holdings occupied	-	18 or 11%
Area of occupied holdings	-	1,763 acres (average 98 acres)
Area of occupied holdings	-	13% of Glenelg acquisition land
Number of inhabitants	-	70 or 3.9 per holding

(f) <u>Tax Delinquent Land</u>

Under the Statutes of the Province of Ontario,** land which becomes tax delinquent is sold by the County Treasurer. In the case of a farm this is not done in practice

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* Northumberland Forest and Angus Forest.

** R.S.O. 1950, c. 24, s. 143.

until the land has been in default for three, or in some cases four, years. Even then the owner has the privilege of redeeming his property within a year. Where such lands are marginal or submarginal, they are sometimes bought for only a part of the area which is of special value, such as woodland, old buildings, or a good field or two. In some instances the poor land remains idle and frequently appears again at the tax sale. The fact that such land becomes tax delinquent is an indication in many cases that its ultimate use is forestry. Under the present Statutes the municipalities are not permitted, at the first sale at least, to acquire or reserve such land for conservation purposes. Consequently this report recommends that the Authority expropriate all tax delinquent land subject to the regulations of the Municipal Act.

(g) Expropriation

As a last resort in land purchases, or where the owners of abandoned land cannot be located, such areas can be acquired by expropriation. The Conservation Authorities Act (R.S.O. 1950, c. 62, s. 15) states:

> "For the purpose of carrying out a scheme an authority shall have the power to purchase or acquire and without the consent of the owner enter upon, take and expropriate any land which it may require and sell or otherwise deal with such land or other property."

Also under the Forestry Act (R.S.O. 1950, c. 147, s. 13) provision is made for the removal of settlers from lands unsuitable for farming. To quote:

> "Whenever in the opinion of the Minister, it is found that settlement has taken place on lands not suitable for agricultural purposes, and which said lands are required for forestry purposes, the Minister shall have power to make arrangements for the removal of such settlers upon such terms as may be agreed upon."

As a matter of general interest, it should be stated that this Act also provides for the power to close the roads on lands taken over for forestry purposes, and the setting apart of lands for settlement, in addition to the removing of settlers from lands unsuitable for farming. It is by Section 4 of this Act that agreements are made with the Department of Lands and Forests for management of Conservation

Authority lands for forestry purposes. This section reads:

> "For the purposes of reforesting, developing and managing for forestry purposes lands held by other persons, firms, corporations or municipal corporations, the Minister may enter into agreements for such purposes with any such persons, firms, corporations or municipal corporations."

There should also be, however, provision in the Statutes for acquiring permanent or community pastures, and pondage areas when these are required, as an integral part of a large conservation project.

2. Cost of Land in the Proposed Saugeen Forest

It would be impossible to give an accurate figure for the total purchase price of all land in the proposed forest without consulting the owners of the individual parcels. However, as an indication for arriving at the approximate cost, the amounts paid by the several Conservation Authorities of the Province in purchasing land for their forest will serve as a guide.

TABLE SHOWING COSTS OF LAND PURCHASED FOR FORESTS

Name of Authority Forest	Acres	Cost $	Cost per Acre $
Ausable	634	12,700.00	20.03
Ganaraska	3,253	22,078.00	6.78
Humber	411	11,795.00	28.70
Moira	985	4,605.00	4.68
Thames	1,980	10,870.17	5.49
Total	7,263	62,048.17	8.55

It should be pointed out too that land acquired in the future by the Ganaraska Authority is likely to cost more than the average price per acre of $6.78 because most of the poorest denuded land has now been taken up and the

remainder has more land which is wooded, to a varying degree, which will naturally raise the purchase price. The very low cost of land in the Thames Watershed is explained by the fact that it is mostly burned-over swamp land with a peat soil which is of no economic value at the present time. Actually the average price of $5.49 per acre includes a ditch tax which exists as a lien against part of the property so that the price of the land itself was closer to $1.00 per acre.

Perhaps a better guide to the Authority on approximate costs to be expected in acquiring reforestation lands are the costs to Grey County of properties in the immediate area which were purchased for their county forest program. These are shown in the accompanying table. The average cost of these lands of $6.00 per acre is very close to the average assessment of these same lots, which is $5.40 per acre.*

The assessed value of land, of buildings where they occur, ownership data and other information were taken from the tax rolls for each of the lots recommended to the Authority for forestry purposes. These data are now filed with the Department of Planning and Development to be used as they may be required in the land acquisition program.

Admittedly assessment values are of limited use as an indication of what individual owners may ask for their property. But they do indicate what expert local opinion considers to be the value of the land under the equalized assessment concept of property taxation which is being applied in the county. Thus they show relative values over a broad area. Although it is intended that the system reflect land capability, it may be said that at the present this is so only in a broad sense, since the technique is relatively new and is constantly under review so that improvements may be instituted.

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* From assessment rolls at the time of the survey.

The titles to several lots which lie side by side are often vested in one owner. The assessment values for these lots generally appear as one entry in the assessment books rather than lot by lot. Often only one of such lots is recommended for forestry purposes under the Authority, and since it is recommended because of its low capability its value is lower than the average for all the lots in the particular holding.

The total area recommended for acquisition is 30,028 acres, compared with 34,892 acres in the total holdings of these owners. The average assessed value of this land*, including the better lots of those holdings which were only partly included, was $8.41 per acre. Where the entire holding of an owner was recommended for acquisition the average assessment was only $5.90 per acre. (This figures applies to 42.7 per cent of the total recommended area and is only a sample of all the land in this category.) The accompanying table gives the assessment data of this sample by landscape types.

The development of a comprehensive conservation program is a long-term project. The present policy of acquiring and reforesting some land each year is a sound one. Where the cost of certain areas is too high, the Authority can afford to wait. The competition for grazing lands of almost any character has increased greatly in recent years due to the high market price for meat animals. This undoubtedly has had its influence on the relative value of lands in the eyes of owners and is a temporary problem which the Authority will have to face. However, the many properties recommended for acquisition for forestry purposes offer the Authority wide choice in its selection of lands.

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* Does not include buildings where they occur.

COST TABLE - COUNTY FOREST AREAS - UPPER SAUGEEN WATERSHED

Tract Name	Township	Year Purchased	Acres	Cost per Acre $
Riddell	Bentinck	1948	100	7.00
Crawford	"	1949	102	7.35
Main	Egremont	1938	66	21.80
Main	Glenelg	1938 -44 -47	674	5.89[a]
Markdale	Glenelg	1938	400	4.37[b]
Kenny	Glenelg	1946 -49 -51	400	3.77[c]
Glenrodin	Glenelg	1946 -51	200	3.50[c]
Dunsmore	Glenelg	1947	100	7.00
Average cost per acre for 1,987[d] acres of the total of 2,042 acres.................				6.00

a - Includes 200 acres purchased from the office of the Commissioner of Agricultural Loans, Ottawa at $3.50 per acre.

b - Includes 200 acres purchased from the Crown at $4.00 per acre.

c - Includes 100 acres purchased from the Crown at $1.00 per acre.

d - Includes 400 acres of low cost land purchased from the Crown but not 55 acres, for which figures were not obtainable.

ASSESSED VALUES OF SOME ACQUISITION AREAS
BY LANDSCAPE TYPES

Land-scape Type	Acquisition Unit	Acres	Assessment		
			Total		Land per Acre $
			Buildings $	Land $	
Glenelg Gravelly Hills	Irish-Farden	4,657	1,800	27,050	5.80
	Allan Park	1,315	1,300	9,150	6.95
	Hanover	450	750	3,900	8.66
Totals		6,422	3,850	40,100	7.14
Swampy Saugeen Flats	Styx River	1,000	750	5,400	5.40
	Bells Lake	940	50	4,200	4.52
Totals		1,940	800	9,600	4.96
Holland Ridge	Boyd Lake	697	1,450	3,750	5.38
	Harkaway	450	150	4,750	10.55
	Walker Lake	650	550	4,800	7.38
Totals		1,797	2,150	13,300	7.77
Dundalk Silty Plain	Osprey Swamp	1,708	650	7,250	4.24
	Proton Swamp	970	-	3,100	3.19
Totals		2,678	650	10,350	3.72
Table Totals		12,837	7,450	73,350	5.90

CHAPTER 8

SNOW FENCES

In the climate of Southern Ontario snow drifting may cause much inconvenience and sometimes hardship. Control can be readily effected by means of windbreaks and is dependent on proper placing with reference to lanes of travel and topographic features.

Where space is limited or land valuable lath or board fences are frequently used, but the cost of erection, removal or maintenance of these can be materially reduced by using trees as permanent windbreaks or shelterbelts. One or two rows of trees are usually referred to as a windbreak and more than two rows as a shelterbelt. The latter is preferable if space permits as it gives better and more permanent protection.

The prevailing winds in Southern Ontario are generally from the west so protection is usually required on the west side of north-south roads, on the north-west side of northeast-southwest roads, on the south-west side of northwest-southeast roads and on the north side of east-west roads.

The object of a snow fence is to mechanically reduce wind velocity near the ground in such a manner as to cause a drift to form where it will be least harmful. The reduction in velocity creates two pools of relatively calm air, a small one on the windward side and a much larger one on the leeward side, and it is here that drifts form, leaving the area further to the leeward free of drifts and comparatively free of snow. The deepest part of the calm pool is close to the windbreak; if the windbreak is open at the bottom - that is, composed of trees with few or no branches near the ground - the deepest part will move further to leeward. As winds become stronger both the depth expressed in terms of velocity reduction and the width of the pool on the leeward side will increase and the centre will tend to move further away from the windbreak.

Highway Protected by Woodland: The protection afforded the highway by trees is well illustrated here. Note how the stretches of road sheltered by woodlots are clear of snow whereas huge drifts have formed opposite the open fields.

Poorly Placed Windbreak: This windbreak, poorly placed with respect to the highway, has created drifts across the public road.

Waterloo County Shelterbelt — Linwood: A twelve rod strip west of the road has been acquired and the six rod strip farthest from the road planted. The remainder will be planted when the original trees are larger.

Weeds must be mowed for a few years until the trees are large enough to shade them out.

A single row of trees, unless it is a dense coniferous type, is seldom dense enough to completely stop winter wind and may create drifts, just as poor placement of windbreaks may accentuate drifting conditions.

A wide belt of trees which will accumulate a large drift of snow on its windward side may be planted right to the edge of the road, the windward edge extending back a distance equal to three or four times the height of the trees and generally at least 100 feet.

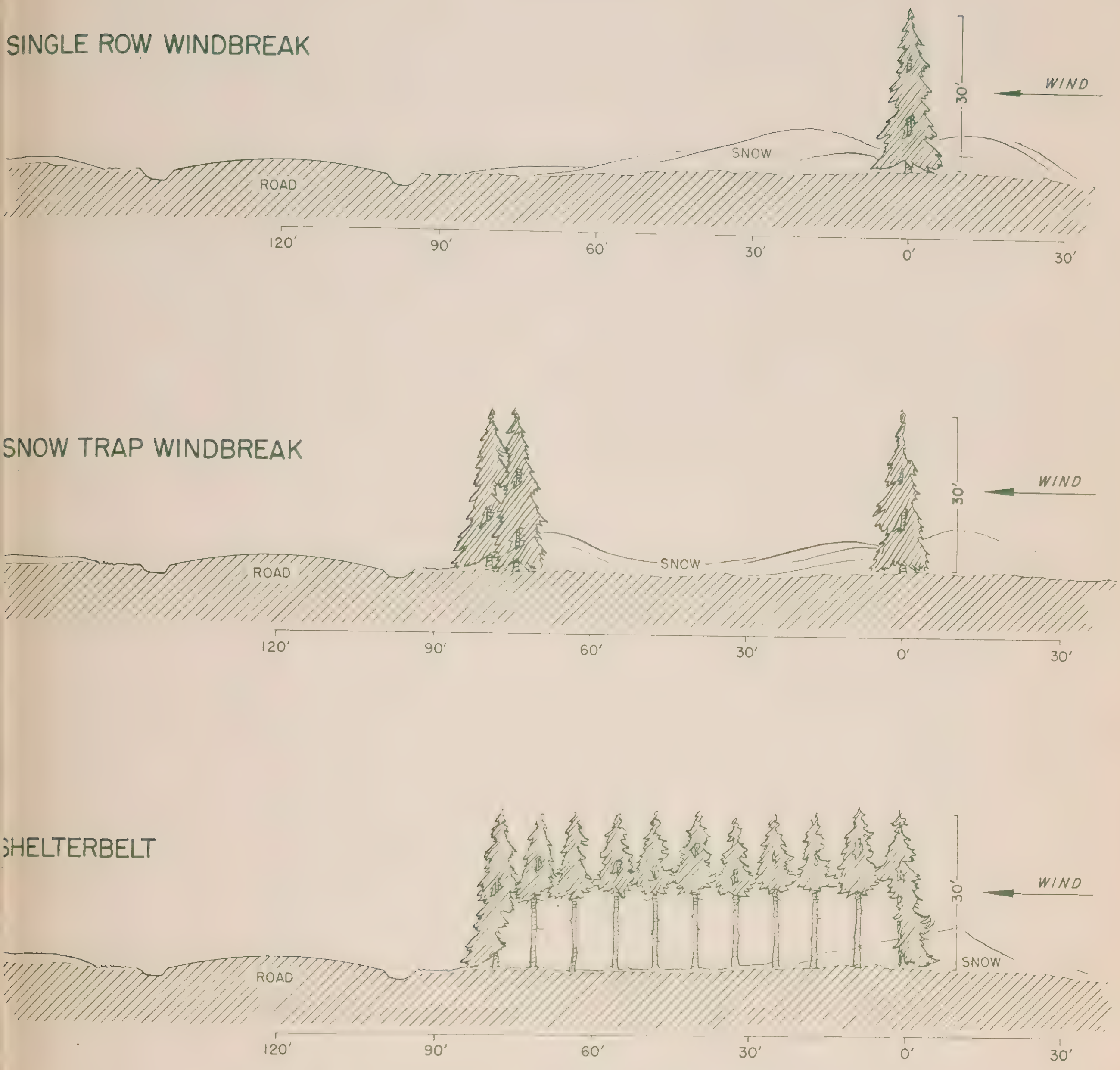
In some places the snow trap type of windbreak is effectively used. It is composed of one or more rows of trees close to the road with a wide opening to windward and then a single row of trees. The single row arrests the first force of the wind and the snow is deposited in the opening. This has the advantage of requiring fewer trees than the shelterbelt and leaving the ground between open for cultivation in summer.

Any prejudice which may exist against windbreaks for protection against drifting snow on roads arises from poor or poorly placed windbreaks. If a windbreak has openings in it or if it ends abruptly streamer drifts will form. Windbreaks should be kept dense and tapered down at the ends by using progressively smaller species of trees and shrubs to prevent the formation of streamer drifts.

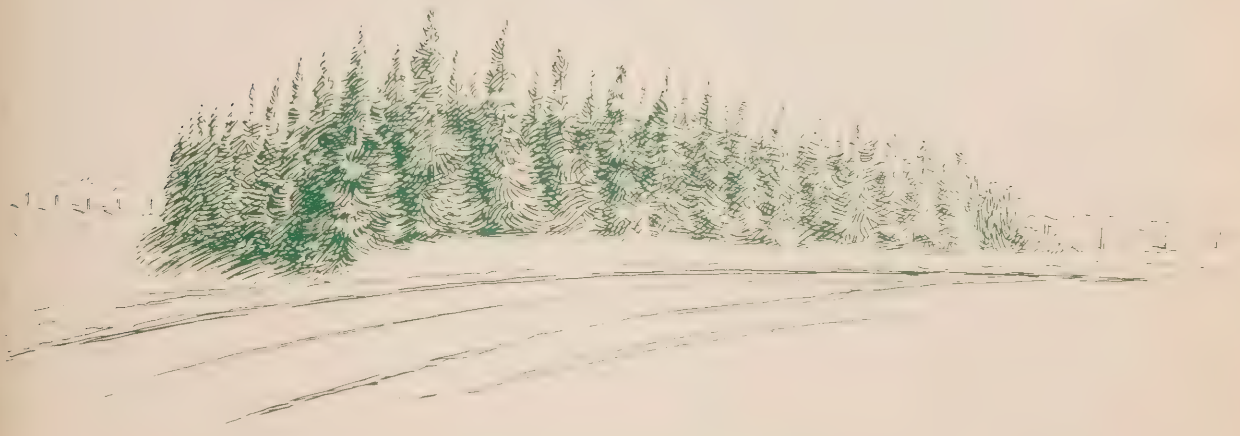
Trees are being used successfully as snow fences in Ontario by the Department of Highways, by railways and by a number of counties.

The practice of the Department is to acquire the land by purchase to a width of 100 feet from the centre line of the pavement and plant a three-row windbreak 80 feet from the centre line. The land is ploughed and cultivated and bushy stock about 2 feet high is used. Weeds are kept mowed between the rows and on the open strip between the windbreak and the pavement, which entails a lot of work on the part of maintenance crews in summer. The windbreaks are kept down to

SNOW FENCES



CROSS SECTIONS OF ROAD AND SNOW FENCES



Two methods of preventing drifts at the ends— left end of shelterbelt terminates at a hollow, right end is tapered down to the ground.

a height of 7 feet, partly because many farmers object to their view of the highway being obstructed and also because they are proud of their herds and fields which they want to be visible to passers-by. Also cutting the tops off the trees reduces the temptation, which some persons find irresistible, to cut them for Christmas trees.

County practice varies; sometimes the land is purchased, sometimes it is leased and sometimes it is planted by agreement. In all cases the county erects a fence behind the trees. In return for the use of the land one county plants a three-row windbreak around the farm buildings. Waterloo County has planted an excellent shelterbelt over four miles long on the west side of the county road running north through Linwood. Here the county has acquired a twelve-rod strip (198 feet) and planted the six-rod strip farther from the road, leaving the six-rod strip next to the road to catch the drift while the trees are small. When the trees get bigger it is planned to complete the shelterbelt by planting the six-rod strip next to the road. The trees used are transplant stock about one foot high obtained from the Department of Lands and Forests and planted in furrows. Weeds are kept mowed until the trees are large enough to shade them out.

The species of trees used are Scotch, jack, red and white pine, white and Norway spruce and white and red cedar. The Department of Highways uses both white and red cedar, which it obtains from areas where they are growing naturally, as well as some species usually considered as ornamental stock which it grows in its nurseries. These include mugho pine, barberry and Chinese elm. This last is the only hardwood tree used in windbreaks. It grows rapidly and its fine branching system makes it nearly as effective as an evergreen tree. The other common hardwoods such as Carolina poplar, white elm, silver maple and white ash are used fairly extensively in shelterbelts.

Snow fences are usually beneficial to crops in that they hold moisture in the fields in the form of snow in winter and reduce wind velocities and moisture loss by evaporation in summer. Occasionally they do cause ice to form over crops such as fall wheat and may be harmful in this way. The beneficial effects, however, outweigh the harmful ones so considerably that every encouragement should be given to their establishment in place of the removable type of lath fence currently in use.

CHAPTER 9

WINDBREAKS

In the process of clearing land for agriculture woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario. E.I. McLoughry* in referring to Waterloo County states:

> "Forests and windbreaks of the county have been removed to such an extent, and the organic matter removed to such a degree, that soil drifting has become a serious problem in many areas...The policy we recommend in regard to windbreaks is to encourage the planting of desirable trees."

When proper species are used and windbreaks are correctly placed the effects are almost entirely beneficial. The effects may be direct or indirect, but in either case are the result of reduction in wind velocity. The effects of windbreaks on crops and cultivated fields may be listed as follows:

(a) Direct Effects

(1) Wind damage and lodging in small grains and corn is reduced or eliminated.

(2) Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher spots where they are required most.

(3) Wind erosion of the soil is minimized.

(b) Indirect Effects

(1) Moisture loss by evaporation is reduced.

(2) Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.

(3) Erosion of the soil by water may be reduced by its more even distribution when released from snow.

The benefits of windbreaks to buildings in reducing heat loss in winter have been shown to be considerable.

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* E.I. McLoughry. Proper Land Use Program of Waterloo County. 1950.

Experiments conducted in the United States proved that more than twice as much heat is lost from a house, per day or per hour, with a wind of 20 m.p.h. as with one of 5 m.p.h., and a windbreak can easily reduce wind velocities in this proportion. Used in this way they can often be made to form an effective background for the house and a protection for farm buildings. Another advantage of windbreaks is that they provide shelter and runways for insectivorous birds and small animals.

Belts of trees comprising one or two rows are usually called windbreaks, and with more than two rows, shelterbelts. In Southern Ontario windbreaks as a rule give sufficient protection except where wind erosion of soil on rolling land is severe, when shelterbelts may be required. On level land windbreaks may nearly always be established along existing fence lines, but on rolling land consideration should be given to the contour of the land. The prevailing winds in Southern Ontario are generally from the west, so that the greatest protection will be derived from windbreaks on the west side, but the placement of windbreaks on the other three sides as well should be considered.

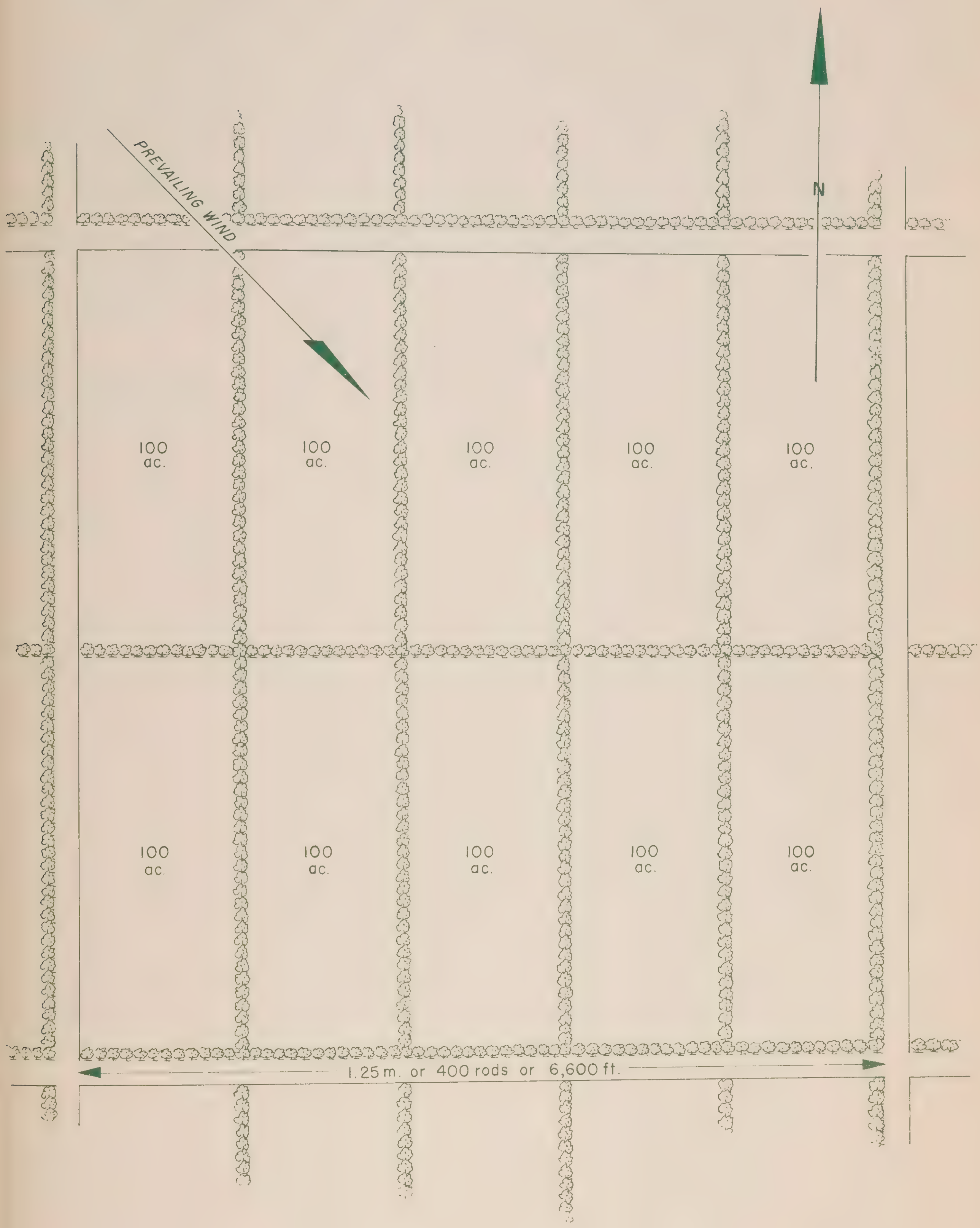
Both the height of the trees and the wind velocity influence the effective range of a windbreak. An average windbreak will reduce the ground velocity of a 20-mile wind 10 per cent or more for a distance of about 30 times the height of the trees. About one-fourth of this effect will be felt on the windward side of the windbreak and three-fourths on the leeward side. For example, if the trees are 40 feet high the total effective range with a 20-mile wind will be 30 x 40 or 1,200 feet, 300 feet of which will be on the windward side and 900 feet on the leeward side. Generally speaking, the reduction in velocity is greatest close to the windbreak and tapers out to zero further away. With higher wind velocities and/or higher trees the proportionate reduction and the effective range will be greater.

A windbreak not only reduces the velocity of wind striking it but also slightly increases the velocity of the wind diverted over, round or through it if there are gaps. The increase in velocity of winds passing over it increases its effectiveness somewhat but the increase in velocity of winds passing round or through it will increase the damage caused. For example, snow drifts will form at these points (see chapter on Snow Fences).

On level land in Southern Ontario windbreaks completely surrounding each farm of 100 acres would normally give adequate protection except for light rolling land and such wind-sensitive crops as tobacco. These should be on the west side of north-south roads, but on east-west roads would have to be carefully placed on the north or south sides, depending on the direction of the local prevailing winds. On land which is not level at least the same proportion of windbreak to area should be provided, but in many cases this would have to be adjusted according to the local topography. That is, the trees should be planted on suitable contours and where hilltops or slopes are eroding badly it will be necessary to establish plantations over a large part of the eroding area. The windbreaks should, of course, be tied in with plantations and existing woodland so that where these exist additional protection would not be required.

Since density, both in winter and summer, is one of the prime requisites of a good windbreak, the conifers in most instances make the best windbreaks. The slower-growing species such as white cedar and spruce give most protection, but the faster-growing ones such as the pines have the advantage of attaining more effective heights in a shorter time. A number of broad-leaved trees have fine, dense branching habits and may be nearly as effective as conifers if the branches are maintained down to the ground; among these may be included sugar maple, Chinese elm and European alder.

WINDBREAK PLAN
for
1,000 ACRE BLOCK



This plan shows the minimum windbreak requirements for a 1,000 acre block on level land. Woodlots and plantations will replace some of this and placement will have to be adjusted according to topography and soil on rolling land.

European alder is gaining great popularity as a windbreak tree because it is a nitrogen-fixer like the legumes and does not rob the soil to the same extent as non-nitrogen-fixing species. In fact, tobacco is frequently planted close to it with little loss in size or vigour of the plants. As the robbing of the soil is one of the severest criticisms levelled against windbreaks, consideration should also be given to the planting of such leguminous trees as honey locust and caragana on certain sites.

One consideration that should be kept in mind is that under certain circumstances windbreaks may cause air stagnation, which may increase temperature and moisture conditions to a dangerous degree in summer or increase frost damage in spring and fall on small areas, particularly in hollows. Where this is likely to occur, windbreaks should be planted so as to guide the flow of air past such spots. Where these conditions develop after the windbreaks are established they may be relieved by judicious opening up of the windbreaks.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way.

CHAPTER 10

THE HARVEST, MANUFACTURE AND MARKETING OF THE WOODLAND PRODUCT

For many years the forests which originally covered most of Southern Ontario were a hindrance to agriculture. The forest was burned and slashed to clear the land for crops and, with only a small part of the timber cut being utilized, the revenue realization from this measure was small. Later the manufacture of lumber and other forest products became an important industry. Exploitation of the forest capital rather than harvest of a crop was the prime motive. This sequence of attack on the forest brought about rapid depletion of the virgin timber.

The dwindling forest resources suffered further as available merchantable timber was liquidated from time to time to bolster set-backs in agriculture. In time of need the farmer derived income through woodland sale.

This process of woodland depletion continued without consideration of forestry as an integral part of the farm business. Yet the most promising means of supplementing farm income to maintain a satisfactory level of living in many rural communities is the husbanding of the forest resources and the development of a permanent woodland enterprise. Many farmers strive for a high yield per acre in agriculture but few give comparable attention to the productivity of their woodland.

When the farm woodlot is managed according to good forestry practice, and the equivalent of the annual wood growth is removed annually or periodically in trees of appropriate size rather than clear-cutting once in a minimum of sixty to eighty years, then the woodlot should provide to the owner, in the majority of cases, a periodic and dependable cash return.

This woodland harvest of appropriate trees cut annually or every few years is termed selective cutting, and

involves the cutting and sale of mature trees which will make logs, the removal for fuel of overmature and deformed trees, removal of the poorly formed immature trees which will not attain sawlog quality, and the removal of other immature trees which are too closely grown. The systematic removal of specific trees not only affords the owner a cash return for his merchantable timber, but also by the eradication of the undesirables decreases the competition for sunlight and nutrition in the residual stand so that the remaining trees, which are most promising, are provided with optimum growing conditions. Thus the merchantable wood-volume of the stand is increased and more logs of better grade are offered to the market. Because of this, the farmer who grows the trees profits; both the sawmiller and the local manufacturer of the lumber produced are supplied with more local material, hence transportation costs are reduced and they profit too; a compensating reduction in the price of the manufactured article is then possible, resulting in reduced costs to the consumer. Thus is seen, as in all undertakings of a truly conservation nature where the highest degree of utilization of our natural resources is achieved, that by the intelligent management of our remaining forest, there is no loser.

However, the profitability of woodland enterprise is dependent upon the availability of adequate marketing facilities. Growing more and better trees is a business and to make it worthwhile the wood produced must be sold and used to advantage. Sawmills on the Saugeen Watershed constitute by far the greatest part of the primary market for forest products, namely logs, and therefore received particular attention. But the market for forest products as a whole is in effect the entire industry which uses wood in all its forms obtained either directly or indirectly through intermediate handlers. Thus a study of the farm woodlot marketing problem should follow the woodland product from the tree on the stump through to its ultimate consumption, whether it be the production of fuelwood,

the sawmilling of logs, the turning of specialties or the complete manufacturing of furniture.

For this reason a study was made of the present market for sawlogs, fuelwood, cedar poles and posts to determine how it functions, the products manufactured, where these go; and on the other side of the picture, the sources of wood for the local secondary wood-using industries, the products manufactured and the area of consumption.

Some of the aspects discussed in this chapter may appear to have little connection with conservation. However, it is pointed out that the Upper Saugeen Watershed is an area where woodland products are important in the economy of many directly and extremely important to whole communities such as Hanover and Durham. The following table shows that nearly half the employed people in Grey County are engaged in wood-using industries. It is only through an awareness on the part of the Conservation Authority of many of the problems which beset the farm woodlot owner, the sawmill operator and the wood product manufacturer that they can intelligently educate and direct people toward the goal of conservation in forest practices. Some of these problems are briefly discussed in the following text.

Conservation is the wise <u>use</u> of resources, and in soliciting individual co-operators the most important device that the Authority can use is to offer tangible proof that the conservation way is the most profitable way to manage lands. Although public undertakings may be important in a general conservation scheme, the contribution of each small area properly managed is an essential part of the aggregate of all contributing properties.

For an effective woodland conservation program it is evident that from the outset there must be close co-operation between local manufacturing industries using local woods and the Conservation Authority since each can contribute considerably

toward the other's objective.

The text which follows is based on the information supplied by the operators of the 20 mills and 9 wood-using industries on the watershed and by those men most intimately concerned with the other two phases of the woodland enterprise described, the production of fuelwood and the harvest of cedar posts and poles.

1. <u>The Timber Harvest</u>

Harvesting is carried on by sawmills whose log consumption is great enough to employ a permanent logging crew, by sawmills whose mill personnel also do the bush work, by sawmills who contract their logging, by loggers who make a business of buying standing timber and selling the logs, and by farmers who sell their logs at the roadside. The logging operation is composed of four separate and distinct phases. These are cruising, cutting, skidding, and loading and hauling. In the following each is treated separately.

(a) <u>Cruising</u>

Cruising is the estimation of timber quantity and quality. When the buyer contemplates the purchase of a woodlot he must have some method of appraising its value. The most accurate method of course would be to measure each tree and, through measurement of diameter and consideration of taper and defect, estimate and tally its volume. This however, would be too time-consuming and expensive to undertake for large tracts of wooded land. The next best method is to estimate the volume and tally only a certain percentage, say 10 per cent or 20 per cent of the trees in the stand, in an area which represents average conditions throughout the woodlot. This percentage can then be applied to the whole area and an approximate volume figure will result. Only one operator on the watershed is presently using a percentage sample to estimate standing timber value, but he has found it to be well worth while - particularly when he is bidding for a woodlot in competition with other buyers.

Professional power saw loggers can make up to 10,000 board feet of hardwood logs (Doyle Rule) per day. The high cost of the power saw is beyond the majority of farmers.

Experienced cross-cut felling gangs can make about 4,000 board feet of hardwood logs (Doyle Rule) per day.

The method used by all other operators visited is that of ocular estimation, that is, arriving at a volume figure by walking through the bush and estimating, on the basis of past experience, the number of board feet in the stand.

By way of illustrating the degree of accuracy possible from a tallied cruise, one operator offered the following information. Some years ago in the competitive bidding for 87 acres of woodland near Durham he estimated a stand, by tallying every merchantable tree, to be 700,000 board feet; the chief log buyer for a large furniture manufacturer estimated 350,000 board feet; another operator estimated 100,000 board feet. The actual volume cut from the stand was 746,000 board feet.

It is generally recognized by the log buyers on the Saugeen Watershed that bidding for timber has become highly competitive in the last few years and will likely continue to be so. It would appear to be to their advantage therefore to consider the merits of the tallied cruise which would enable them to estimate and bid more accurately on woodland in which they are interested.

(b) Cutting

Felling and bucking is done by two basic methods - with the crosscut saw and with the gasoline-powered chain saw.

Under optimum conditions, that is large dimension hardwood timber growing in reasonably dry level bush in which there is but light underbrush, an experienced two-man crosscut crew can make up to 4,000 board feet of logs per day. The average daily output is closer to 3,000 board feet. That diameter, number of merchantable trees per acre, topography and density of underbrush greatly influence the quantity of logs produced is shown by the figure of 1,500 board feet, which is the expected daily average of a two-man crew cutting in a softwood swamp where working conditions are not as good.

Power saws are being used more extensively from year to year. When they were first introduced, mechanical

failure, weight and breakdowns due to misuse through inexperience on the part of the operator resulted in prejudice against them, but time and improvements have brought them to the point where they are now generally accepted. Power saws still require a considerable capital outlay, however, and this seems to be the main deterrent to their use by all cutters. Most men who make their living at cutting use this saw and one of the larger wood-using industries encourages its cutters to buy power saws by financing the purchase and taking a portion of the cost out of each pay cheque. Because the daily production per crew is almost trebled with the chain saw (10,000 board feet per day is not uncommon), this company feels that the step they have taken is warranted.

Locally, cutters are paid from $4.50 to $10 per thousand board feet, with the average being close to $6. The variation in rate is dependent to a certain extent upon the employer, but the type of bush in which the cutting is done exerts the greatest influence. If there is much brush, or the ground is wet, or the trees are spaced widely apart making it difficult for the cutters to produce in quantity, the cutting rate is lower. Though heavy work, cutting pays well and an experienced two-man crew with a chain saw can make up to $60 per day. Cutting with this saw is easier work and the cutter therefore is more likely to make his first cut lower on the bole undeterred by butt swell, and to make extra cuts to remove defective sections from the tree. In this way a higher degree of utilization is practised and as the cutter produces more logs in less time and receives more money per day, the use of the gasoline-powered chain saw should be encouraged.

As pointed out, a great deal of the cutting is done by men who make this work their livelihood. Many of the professional loggers who cut in the Saugeen Watershed are Indians from the Southampton area. However, there is also considerable cutting done by the farmers who own their own woodlots. This is almost entirely the case with owners of second-growth stands of

such merchantability that a large-scale harvesting operation is unprofitable. Some farmers would rather do their own cutting a bit each year, and thus provide a labour income during the slack winter season. This labour income would not exist if their bush was cleared of merchantable timber by professional loggers.

Data appearing later in this chapter indicate that in a typical hardwood operation the value of the logs at the roadside may be about half as much again as that of logs in the tree. The difference lies chiefly in the value of the labour required in making the logs and placing them at the roadside. The example which follows shows the typical increase in the value of logs as they are made from the tree and moved to the mill.

Value of the logs at the millyard - $50 per M board feet

Costs per M Bd. Ft.	(Hauling logs to mill	- $ 8
	(Skidding logs to road	- $ 6
	(Making logs from tree	- $ 8
	TOTAL	$22

Thus the value of logs in the tree (stumpage) is $28 per M board feet.

The farmer may easily perform the operations of cutting and skidding, which here total $14 per thousand board feet, and instead of selling only stumpage sell also his labour and the use of his equipment and so increase his return for producing logs on his land by (in this case) 50 per cent. It is recommended that the Authority carry out a program to encourage farmers to fit the woodlot into the work plan for the farm according to available seasonal labour. The production of no other farm crop offers such time flexibility as woodland work and the relationship* between direct expenses and cash receipts is much better for the woodlot enterprise than for the rest of the farm business. Preston† offers extensive data to support

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* Bureau of Agricultural Economics, and Forest Service; U.S. Dept. of Agriculture: Woodland Opportunities on Dairy Farms in New York. 1944 Published by the Charles Lathrop Pack Forestry Foundation, Washington, D.C.

† Preston, J.F. Farm Wood Crops. McGraw-Hill Book Co. 1949.

the conclusion that the provision of 1/2 to 1 man-day of labour per acre per year will improve a woodland so that over the years its dollar yield will be about four times that of unmanaged woodland.

Cutting on shares is also quite common. Under this arrangement a man or a crew go into a woodlot and cut out the saleable logs specified by the owner. They receive no pay from him immediately but take a percentage of the return, usually half, which is realized when the logs are finally sold.

Most of the cutting is done during the winter months, though some of the larger operators cut hardwood the year around. Winter cutting is necessary with the majority of softwood cuts because of the character of the softwood sites. Softwoods in the Saugeen area are mostly confined to wet areas and are often of a boggy nature which makes poor footing for both the cutter and the horse doing the skidding. This condition is also often true of soft maple - white elm stands. Unless the dampness of the soil is caused by the presence of flowing springs, winter's frost hardens the ground and makes the operation much easier.

(c) Skidding

Though the horse has largely given way to the farm tractor, it is still an indispensable part of the woodland operation. Skidding is the transportation of the log from the place where the tree was felled to a roadway where it can be loaded onto a truck. Though a caterpillar tractor or a winch has been used for this purpose, in the majority of cases, due to irregularity of terrain and density of forest, the horse still provides the only satisfactory medium of power. In this watershed skidding costs from $2.50 to $7 per thousand board feet. The price paid depends largely upon skidding distance. The average is close to $6 per thousand board feet.

(d) Loading and Hauling

One sawmill on the area has a mechanical loader which is used on larger operations, but in all other cases

Some damage in felling is inevitable even when the logging is done by expert cutters.

Log skidding to roadside for truck haul. This professional teamster and team were brought by truck more than 60 miles to do this skidding.

loading is done with the "A" frame jammer. It is set up at the skidway and a farm tractor or team of horses supplies the power to lift the log onto the load. The jammer in most cases belongs to the trucker who does the hauling. When logs are sold at the roadside by a farmer who has done his own cutting and skidding, it is general practice that he supplies either the tractor or the horses.

Hauling on the Saugeen is done entirely by trucks, the majority of which are privately owned. Hauling distance to the local mills rarely exceeds 50 miles and this would be for grade 1 logs hauled by one of the larger mills. A haul of 15 to 20 miles would be about average and far more common. The smaller softwood mills do not go as far afield. Their average haul distance is about 10 miles with a 25-mile maximum.

Hauling costs depend largely on distance, and the charge is made per thousand board feet hauled. Seldom is it less than $3 per thousand board feet and for long hauls can run as high as $15.

The beginning of truck hauling, large-scale depletion of the farm woodlots and disappearance of many portable mills are quite closely allied. Before the days of the motor truck, hauling was done by sleigh and it was a common sight to see the sleighs lined up for a quarter of a mile, waiting to dump their loads at the mill. As the sleigh was much slower than its piston-driven successor, the hauling distance was much shorter and therefore the supply source was confined to an area in the mill vicinity and the more remote areas were harvested by the portable mill. Truck hauling in the summer months was first attempted in the area in 1920 in an attempt to circumvent the bottleneck of winter log delivery. An expensive tractor trailer was purchased by a Durham mill and the operation begun. However, motor traffic was not great enough at that time to demand good highway and secondary road maintenance and the log-heavy trailer spent so much time bogged down where it had broken through culverts that the scheme was abandoned. It was not until

the early 30's that truck hauling started in earnest, thus extending the practicable hauling distance and granting permanent sawmills access to more timber. Thereafter the number of woodlots decreased and the portable mill operators found areas of woodland extensive enough to warrant the cost of moving and setting up the mill increasingly scarce.

2. The Fuelwood Operation

The fuelwood operation as a business in itself has largely disappeared from the watershed. This is due, at least in part, to the large number of former fuelwood consumers who now use coal and oil for heat, but a more important reason is the passing, in both Bruce and Grey Counties, of the minimum diameter limit by-law. In general this law prohibits the cutting for commercial purposes of trees below a stated diameter. In the past the operator had been able to clear-cut a woodlot, that is, to cut the small as well as the large trees. In this way he had been able to take out enough wood to make the fuelwood operation profitable. The adoption of the minimum diameter limit by-law, however, now prevents him from removing the small diameter trees so that his return of wood per acre, and per man-hour, is substantially decreased. Actually, as far as woodlot acquisition is concerned, this puts him in competition with the log buyer and as most merchantable timber is worth more as lumber than it is as fuelwood the log buyer is able to offer a better price - with the final result that the fuelwood operator is reduced to contracting the tops and culls which are left after a logging operation. Under this arrangement most of the larger trees have been cut, those that remain are likely to be branchy and crooked, and though there is considerable fuelwood in the tops there is more work connected with their removal. This means a much smaller margin of profit and probably accounts for the fact that only one fuelwood operation could be found on the watershed in the summer of 1951. It would appear therefore that little fuelwood is being cut - but this is not the case.

The quantity of fuelwood produced is not immediately evident because of the log buyer's policy of removing the logs and, wherever possible, leaving the tops and culls in the bush as, in effect, part payment. The fuelwood made, and usually consumed, by the farmer-woodlot owner from this logging waste constitutes by far the greatest percentage of the total production.

To have the fuelwood made up costs the owner, in the event that he does not do the work himself, $2 for a short cord, that is, 8 feet by 4 feet, 14 inches wide, stacked, in the bush. This same 14-inch cord of hardwood fuel sells locally for about $6 delivered.

3. <u>Cedar Posts and Poles</u>

The Saugeen Watershed is one of the important cedar post- and pole- producing areas in the Province. It has been estimated by those most intimately concerned with cedar products in the area that about 50,000 posts and 5,000 poles are removed annually from the 400 square miles under study in 1951. To obtain an exact figure of the yearly quantity removed is difficult because of the diverse methods by which the crop is harvested and sold. For example, farmers themselves cut cedar from their swamps and, with the exception of the posts they use for their own fencing, sell to dealers at the roadside. The dealers are not necessarily local people and unless every farmer in the watershed is visited a tally of the posts sold in this manner becomes impossible.

The variations in the buying and selling of cedar are many. Besides the farmer who cuts his own swamp there are local dealers in cedar with years of experience who estimate the value of a swamp by ocular estimation, make the owner an offer, arrive at a figure agreeable to both and then take out the trees in the form of posts, or, if they are large enough, poles. The posts are usually trucked south by the dealer to the London-Stratford farming district where cedar does not grow

in quantity, and are sold often by the door-to-door method. There are lumber yards in the south that handle posts but they do not provide a market for the cedar products of the local dealer as their posts are imported more cheaply by the carload. Dealers who use trucks have little to do with southern wholesalers. The poles have a local market with the telephone and hydro companies. Some of the truckers who come up from the south are actually dealers in posts themselves, but for the most part they are individual farmers who are attempting to save transportation costs by using their own equipment. They buy a single load of posts and sell what they do not need themselves to their neighbours. Another common practice is that of the Grand or Thames River Valley farmer who comes north with a load of corn, sells or barters it locally and returns with posts.

Posts are valued according to diameter at the small end. All posts except anchor posts are a standard 8 feet in length. The anchor posts are a foot longer. Poles are graded as to length with a minimum diameter at the small end of 6 inches. The prices obtained in the spring of 1951 for posts and poles piled at the roadside are listed below by diameter and length grades. The price differences are due to the variation in the quotation given by different dealers. Also dry-site cedar has a tendency toward heart rot. Small amounts are acceptable but as the ratio of heart rot diameter to butt diameter increases the post loses value, and if excessive the post is worthless. Buyers will allow a 1-inch heart rot in an 8-inch butt, but a 2-inch heart rot for the same butt diameter completely destroys the value of the post.

POSTS

(Eight feet in length)

Diameter small end	Roadside Price paid per post
2-1/2" to 4"	10¢ to 15¢
4" to 7"	30¢ to 40¢

Diameter small end		Roadside Price paid per post
8" to 10"	....	80¢ to $1.00
Anchor post 7-1/2" up, 9 ft. long	....	70¢ to 80¢

POLES

(Minimum top diameter 6 inches)

Length in feet		Roadside Price paid per pole
20	....	$ 1.50 to $ 2.00
25	....	$ 2.25 to $ 2.75
30	....	$ 5.00 to $ 7.00
35	....	$ 8.00 to $10.00
40	....	$20.00 to $25.00
45	....	$35.00 to $40.00

Cedar is being used more and more for lumber, particularly for two-by-four's and ties. Therefore most logs over 8 inches in diameter are sawn rather than sold as posts. A straight, sound post 9 feet long with a 10-inch top diameter is worth $2 when sawn into two-by-four's at 50¢ each. If it is only squared to a 7" x 7" tie it is worth $1. As an anchor post it is worth only 70¢ to 80¢. Anchor posts therefore are usually those with a little heart rot or crook or both.

Cutters are paid by the post. The tree is felled, trimmed and cut up into lengths of 8 feet. Cutting costs run from 8¢ to 15¢ per post depending on the character of the swamp. Skidding adds another 4¢ to 8¢ to the cost of producing the posts, again depending on the type of swamp. Frequently, in a swamp that is not excessively wet or dense or otherwise difficult to move around in, cutting and skidding are done together for a cost of 15 cents. Referring to the price list preceding, it may be seen that the smaller posts, which are used as grape stakes in Southern Ontario and the United States, bring only the bare cost of production. It may be wondered why these small-diameter posts which come from the tops of the

trees are bothered with at all. The fact is that cedar swamps are usually so thick that these tops must be removed to make space enough in which to carry on the operation. Otherwise they get under foot and slow up the work. It is therefore more profitable in the long run to take them out and sell them for cost, or even a little less, than to leave them in the bush.

The character of the cedar swamp determines its value. Close-grown merchantable stands are the most valuable. Some swamps have other softwoods with the cedar. In this case the cedar posts are usually taken out first and the remaining spruce, pine, balsam or hemlock logs are taken out afterwards in a separate operation, on either a per thousand board feet, or per log, basis. Merchantable softwood swamps are currently valued at from $25 to $500 per acre.

4. Sawmilling

(a) Sawmilling in the Area

At the time of the survey there were 20 mills on the watershed. Eighteen of these mills were converting logs into lumber or dimension stock while the other two, which are discussed later, were specialty mills producing basket bottoms. One mill had gone out of business during the past year and another was under construction. The mills varied in size from large well equipped establishments employing fifteen men and producing over 1.5 million board feet of lumber annually down to small truly portable units with a hand-operated carriage.

On the basis of figures supplied by the operators, the 20 mills produce annually just a little less than 7,000,000 board feet. Though this figure represents the amount of sawing done on the watershed it does not necessarily represent the amount of logging. The reasons for this are straightforward. On occasion some of the mills may obtain their logs from woodland which is as much as 60 miles from the mill site, or wherever material is available, and hence much of their supply may come from outside the area studied. Also logs are hauled from

SAWMILLS
UPPER SAUGEEN WATERSHED
1951

within the area to mills outside the watershed boundary. All in all, the amount of material going out of the watershed is probably less than that being brought in because so many of the larger mills within the area are near its boundary. Thus it is possible that the total amount of logging within the area does not exceed 5,000,000 board feet, whereas the milling actually done in the area is almost 7,000,000 board feet.

The mills visited, though some of them were of the portable type, were, with one exception, located on a permanent basis, that is the owner did not contemplate a move in the foreseeable future. In the case of the one mill that intended to move, the distance to the new location was only five miles, and that mill site was to be permanent. Therefore the mills on the watershed can be considered to be of a permanent nature. This is a desirable situation as is explained in a later section, Types of Mills - Portable and Permanent.

There are no growth rate, yield or inventory data for the Southern Ontario woodlots. It would be useful to determine whether the current annual cutting rate is in excess of the annual growth. Logging operators state that the sawlog yield from hardwood stands containing immature, mature and overmature trees is generally in the neighbourhood of 6,000 board feet per acre (log scale by Doyle Rule). Yields of 10,000 board feet have been experienced but they are the exception rather than the rule.

At a yield rate of about 6,000 board feet per acre and at the current cutting rate, the 20 mills studied are, in effect, more or less clear-cutting an estimated 1,000 acres of unmanaged woodland each year. At this rate the mills in the area are overcutting the size class of timber desired at about two to four times the rate at which it is being replaced. If this condition persists the forest will become dominantly small-sized and the industries dependent upon it will have to radically adjust their consumption rate or look elsewhere for timber. It would take in the neighbourhood of 100,000 acres of

productive woodland under practices prevalent in the last twenty years to sustain the current cutting rate, whereas considerably less than half of this acreage exists.

However, if a fair degree of woodland management is soon instituted over the entire area, it can be shown that as the existing woodlands recover they will be able to support the current cutting rate on a sustained basis.

(b) Mill Output

(1) Daily output for sawmills other than specialty mills varies from 800 to 8,500 board feet with an average sawing rate of 3,000 board feet. The specialty mills (basket bottom manufacturers) consume from 300 to 500 board feet per day and their output is measured in units of production rather than board feet. As there is more actual sawing done in the specialty mills, their daily output in actual board measure cannot be expected to equal that of the mills producing lumber.

American studies (Nelson C. Brown - Lumber) indicate that the output of small sawmills varies directly as the number of men working at the mill, being about 1,000 board feet per day per man - a predominance of hardwood lowering this figure. The average production per day per man in the mills studied on the Saugeen Watershed is near 700 board feet and hardwoods predominate in the area. A breakdown of daily and annual production by species is shown in the following chart.

(2) Relationship - daily and annual output

Assuming 275 working days in a year, at an average production rate of 3,000 board feet per day the 20 mills on the watershed should produce about 16,5000,000 board feet per year. However, the annual production totals less than half this amount. This is because only a few of the mills work a full year and the annual operating time for some is as little as 20 days.

A third of the mills on the area are farmer-operated and not worked on a full-time basis, but even among

PRODUCTION AND SPECIES DATA IN THOUSANDS OF BOARD FEET BY MILLS

Mill No.	Days Worked per Year (approx.)	Daily Output	Annual Output	Annual Custom Output	Custom Per Cent	Annual Production by Species											
						Hard Maple	Elm	Bass-wood	Beech	Birch	Black Cherry	Poplar	Other Hard-woods	Hem-lock	Cedar	White Pine	Spruce & Fir
1	275	6.0	1,550	None	-	1,000	100	200	150	16			34	50			
2	180	6.0	1,000	20	2	600	40	75	75	150			10	25			25
3	125	6.5	800	16	2	400	100	200	75				25				
4	275	3.0	700	0	-	500	50	100			50						
5	275	5.0	650	3	.5	400	50	50	50	30			20	25			25
6	135	4.5	600	0	-	360	120	15	75	4	8	15	3				
7	125	4.0	500	50	10							50		100	100	50	200
8	50	3.5	175	175	100	5	75					10	3	75	1	1	5
9	60	3.0	175	175	100							25	10	45	20		75
10	30	6.0	150	15	10	100	20	20					10				
11	60	3.0	110	70	65	35	12		5	5		7	2	7	7		30
12	60	1.5	100	25	25	35	25		25				15				
13	60	1.5	90	45	50									30	10	10	40
14	40	2.0	50	25	50							3		5	15	2	25
15	20	3.0	50	0	0	35	5	2	3					2	1	1	1
16	50	1.5	50	37	75							5	10	5	5		25
17	80	.5	50	0	0							45			5		
18	60	.4	40	0	0							5		3	30		2
19	30	1.0	30	30	100	5	12	2	3					5	3		
20	30	.8	20	20	100									3	10	2	5
Totals		62.7	6,890	706	10	3,475	609	664	461	205	58	165	142	380	207	66	458
Average		3.1	350	Per Cent		50	9	10	7	3	1	2	2	5	3	1	7

CORRELATION OF SPECIES SAWN AND SAWMILL PRODUCTS
(Figures are those supplied by the operators and are Thousands of Board Feet per Year)

Product	Species													
	Hard Maple	Beech	Elm	Bass-wood	Birch	Ash	Hick-ory	Black Cherry	Poplar	Hem-lock	White Pine	Cedar	Spruce & Balsam	Total	% of Total
Hardwood lumber for furniture manufacture	2,840	393	547	560	185	35	60	30	25					4,675	68.00
Construction lumber	5	3	12	4					85	290	40	113	370	922	13.40
Ruler stock	250	35	25	50				13						373	5.40
Heel stock	135	2	25	50				10						222	3.20
Chair stock	5	1				30								36	.52
Shims	100	20			18			5						143	2.10
Ties	5	2			2					25		30	60	124	1.80
Highway sign posts												25		25	.36
Roadside tables											25	5		30	.43
Hydro cross-arms												10		10	.14
Shingles												3		3	.04
Basket bottoms									55			20	2	77	1.10
Crating										40	1	1	1	43	.60
Box wood										25			25	50	.71
Export to U.S.A.	135	5				7	10							157	2.20
Totals	3,475	461	609	664	205	72	70	58	165	380	66	207	458	6,890	100.00
Per Cent of Total	50	7	9	10	3	1	1	1	2	5	1	3	7	100	

lumbermen who depend upon sawmilling for their entire income, mills are sometimes shut down for as much as six months of the year, and among small sawmills (those listed in the accompanying chart as producing less than 500,000 board feet per year) four months of inactivity is very common. In most cases the idle period is between November and April. When sawing during these winter months it is advisable to add a log pond to the mill, but few of the mills have such an installation. Rather than put out capital for this purpose the sawmiller often employs his mill crew in the woods, thus taking advantage of the cold and snow which are favourable to logging operations. It was explained by one operator that although he would rather saw the year around, he gets his logs more cheaply and more dependably by putting his milling crew in the bush during the winter and supervising the operation himself than he does by hiring a logging crew to take out the logs.

(3) Annual output and custom output

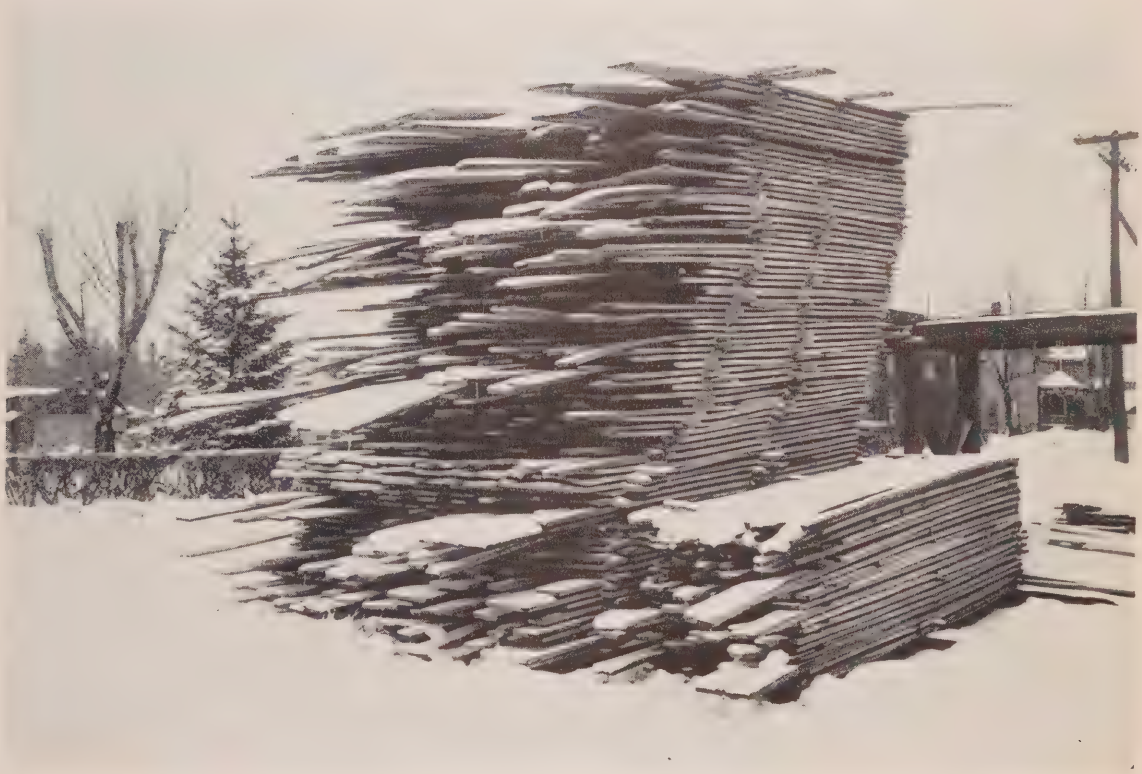
The largest total output among the mills visited is just over 1-1/2 million board feet per year. The twenty mills in the area annually saw about 6,890,000 board feet of lumber of which 10 per cent is custom sawing. The chart previously referred to lists the mills in order of total annual production; percentage custom sawing of total annual output is shown.

In general, as the annual output increases the custom per cent decreases. For clarity this statement is represented, on the basis of figures supplied by the sawmillers in the area, in table form.

	Mills Sawing Less than 200,000 Board Feet Yearly	Mills Sawing More than 200,000 Board Feet Yearly
No. of mills	13	7
Per cent of all mills	65	35
Per cent of all sawing	16	84
Per cent of all custom sawing	87	13

Farmers often do very little of the woods work. This lump sum purchase bought only the logs that could be made. The farmer paid the buyer's cutting crew to make the tops and limbs into 4-foot fuelwood.

Poor piling of random lengths. The grade of lumber is often lowered during seasoning due to poor piling practices which encourage warping.



(c) Custom Sawing

(1) General aspects

Although small mill owners do the majority of the custom work they state that custom sawing is not particularly profitable; it is undertaken as a service to the community and the mill serves a convenience to their own needs. Large mills definitely discourage custom work. This attitude appears to be justified. Cost-accounting records of larger mills have shown it to be unprofitable. In fact it pays only for the direct labour involved and other overhead must be absorbed by the company. This situation arises from the extra labour necessary to saw from a given log the sizes of product specified by the customer, in additional handling, and separate piling - with a resultant disturbance to mill routine. Thus mills with a relatively large output and with yard storage space at a premium cannot do custom work profitably. The small amount of custom work that is handled is usually done as a favour to the log owner in consideration of friendship, or as good business to promote new sources of log supply.

When a woodlot owner needs a quantity of lumber for a new building or for repair of an old he takes whatever logs he can to the mill. Often the value of the species and the grades that can be sawn from the logs are far above that warranted by the use to which the material is put. He would be well advised to take credit for his logs and let the operator provide him with species and grades best suited to his requirement. The mill owner should supply these at preferred prices where he would be able to dispose of his poorer grades or species of low market value which he has on hand and in return receive a better quality of material which can be put to a more economical use.

To illustrate the preceding the following case is assumed. A farmer, in need of lumber for repair work, brings six logs to the mill to be sawn into two-by-fours. The

logs are straight, have a top diameter of 12.5 inches and are 14.5 feet long. These logs should each make eight two-by-four's. If the miller supplied the farmer with the same quantity of two-by-four's from a stock pile he could, assuming satisfactory quality of the logs, saw from them two-by-eight's or larger dimensions which are worth more money. Again, let us suppose that the logs supplied are white pine. Several of the local softwoods provide the strength qualities necessary in two-by-four's. The top price paid for white pine locally is $110 per thousand board feet. If the two-by-four's provided by the miller were spruce, the top price of which is $70 per thousand board feet locally, a gain of $40 per thousand board feet can be realized by the farmer. This is assuming that both the spruce and the white pine are of first-grade stock. If the white pine offered is a higher grade than the miller's spruce a further profit could be realized.

(2) Ratio for sawing

The general practice is that charges are made at a set rate per thousand board feet mill run - the rate being common to all species. Some mills charge at a straight hourly rate which covers the time of log handling in the yard, sawing, piling and mill stoppage due to staples, tapping spiles and other metal objects embedded in the logs. Other mills combine the two methods, charging per thousand for average run logs but a comparatively higher rate for small logs. Unless otherwise understood the slabs, edgings and sawdust which accrue from the sawing belong to the mill operator.

The custom rates of the following mills give a sample pattern over the area. (There is no relation between mill number here and the mill number in other listings.)

Mill No.	Custom Sawing Rate	Custom Planing Rate
1	$10 per M Board Ft.	

Mill No.	Custom Sawing Rate	Custom Planing Rate
2	$15 per M Board Ft.	
3	$15 " " " "	$11 per M Board Ft.
4	$20 " " " "	
5	$10 " " " "	$ 4 " " " "
6	$12 " " " "	$ 5 " " " "
7	$15 " " " "	
8	$15 " " " "	
9	$ 3.50 per hour	
10	$12 per M Board Ft.	
11	$14 " " " "	
12	$14 " " " "	$ 6 " " " "
13	$15 " " " " or $ 7 per hour for small logs	

(d) Types of Mills - Portable and Permanent

Manufacturers of portable mills have incorporated in them certain limiting features of construction that might distinguish them from permanent mills. Usually they have no double edger. Also, because they are built to be portable, their construction limits their efficiency and thus the quality of the product sawn out. In addition, however, in order to operate, the portable mills need a large quantity of timber confined to a comparatively small area because the cost of moving the mill to the new location as well as the actual cost of the sawing must be absorbed before a profit is realized. As areas producing timber in quantity great enough to defray this overhead are now scarce, the remaining portable mill operators have been inclined to ignore the minimum diameter limit by-laws and more or less clear-cut the woodland.

> "Owing to the development of excellent highways and secondary roads and the improvement in efficiency and lessening in cost of operation of logging trucks, the tendency is toward more stationary and permanent location of mills. It is usually cheaper to move logs from the woods to the sawmill, even eighty miles or more if they are high quality logs, than

it is to move the sawmill to the forest".*

This has been found to be emphatically the case in the area studied on the Saugeen Watershed, as only one of the twenty mills visited was contemplating a move and this was a matter of five miles to his own farm, which location would then be permanent.

This tendency toward the more stationary location of mills rather than numerous truly portable mills reduces the threat to woodlots. The threat now exists in the form of motor transport of logs, <u>the flexibility of which can be more readily directed to favour woodlot improvement by selective cutting or other good forestry practices</u>.

(e) <u>Reasons for Frequency of Small Sawmills</u>

When sawmilling first began in this section of the country in the middle 1800's the mills were located where water power was available. As the timber supply within practicable hauling distance of these mills was gradually depleted there was an influx of portable mills which reached a peak about 1915. Since that time the trend has been toward many small mills producing less than 1 million board feet per year and sometimes as little as 30,000 board feet. The reasons for the establishment and continued operation of these small mills are summarized as follows.

(1) <u>Minor capital outlay</u>

Approximately one third of the mills on the watershed are farmer-operated, that is, they are owned by and located on the land of a farmer who saws logs in the intervals between seeding, haying etc. when his time is not demanded by the farm itself. A farmer-operator can set up a mill for as little as $500. A small mill operated by a professional lumberman can, by utilizing second-hand equipment, be put into operation for less than $2,000. The price differential is

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* Lumber. Nelson G. Brown. 1947.

chiefly in that the farmer-operator often has his own power in the form of a farm tractor already purchased, he has no rental outlay for land and often has old lumber or buildings which can be used to house the mill equipment.

(2) Suitability of small sawmills to the present situation

The situation referred to is due to the sporadic light supply of logs to the mill.

The number of good merchantable woodlots is becoming increasingly scarce. For the most part the logs which are now being harvested are second growth. A supply of logs in sufficient quantity to insure year-round sawing is now the exception rather than the rule for many mills. This is shown by the practice of sending the mill employees to the bush from time to time throughout the year whenever the stock of logs at the mill becomes depleted. The large mill which generally employs more specialized townsmen cannot as readily adapt itself to this arrangement as can the small mill with the labour force it employs.

As a whole the woodlot owners do not strive to manage the forest that is left in a manner which will give high quantity and quality yield. Their attitude toward the bush varies from complete apathy, to, in a few cases, a conscientious attempt at proper woodlot management, but the number of owners in the latter category, though on the increase, is still far too small to bring about growth which will promise an adequate supply of logs for year-round milling for all mills.

(3) Availability of power

The several types of power available and suitable to the needs of the small sawmills favour their continued existence. The multi-purpose farm tractor provides one source of power. It is usually part of the farm equipment and the farmer-mill operator therefore does not have an original capital outlay for a power unit. Old automobile and motor truck engines and the somewhat more economical diesel engine provide other

common and relatively inexpensive sources of power. Hydro-electric-powered mills appear to be the most efficient. Their power cost per unit of production is claimed to be less than that of other mills except those using water power and their fire hazard is also greatly reduced.

These types of power are in contrast to the expensive steam units of the large mills which have a high maintenance and labour-operating cost and create an extreme fire hazard.

The types of power used by the mills studied is shown on a percentage basis.

Type of Power	Percentage of Users
Hydro	25%
Steam	20%
Water	15%
Diesel	15%
Gasoline Tractor	15%
Converted Gasoline Engine	10%

(4) Farmer and other local needs for lumber

The necessity for repair of farm buildings and equipment and the occasional need for new buildings provide sawing for small sawmills working chiefly on a custom basis. Since these mills are not forced to make provision for high overhead, the probability of extended periods of idleness is of little consequence to the owner.

(5) Increased lumber value

The market price commanded by standing timber has risen considerably since the end of the Second World War. Whereas hard maple logs might sell locally for $90 this year, in 1946 the same logs were worth only $70. A similar proportional increase is true of other species and lumber prices have increased correspondingly. These attractive lumber prices start many mills. Of the 20 mills now operating on the watershed 11 have begun operation in the last five years.

(6) Species sawn

Again referring to the chart on the production of the mills by species it is seen that the mills fall into two general groups - those which saw mostly hardwoods for furniture manufacture or dimension stock, and those which saw mostly softwoods for construction lumber. The custom sawing mills, by the very nature of their enterprise, usually saw both.

Sixty-two per cent of all the sawing is hardwood. By far the most important species within this class (60 per cent of hardwood total) is hard maple, of which there is over 3,000,000 board feet sawn annually. Elm and basswood each account for over 600,000 board feet each year and over 450,000 board feet of beech is sawn annually. Other hardwood species sawn on the watershed are white and yellow birch, balsam poplar and trembling aspen, black cherry, soft maple and white ash.

Of the softwoods, spruce and balsam, which are lumped together by the sawmillers, rank first in quantity sawn, followed closely by hemlock. About twenty per cent of the softwood total is cedar. White pine, the only other softwood sawn, is scarce.

(f) Mill Products and By-Products

(1) Direct products

The direct products of the mills visited are listed in the accompanying table and are correlated with species. Of all the hardwood logs sawn, almost three-quarters go toward the supply of lumber for the local furniture manufacturers. About ten per cent of the total, most of which is softwood, is sawn into construction lumber. The remainder is divided among the other products.

Eventually, in the manufactured form, the wood from the watershed turns up on the market from coast to coast in Canada, and in parts of the United States. It appears in

the form of rulers, wooden heels for shoes, seats and rungs for chairs, railroad ties, and shims to wedge between the rail and the tie to keep the track level, squared posts for highway signs and round posts for fencing, Department of Highways' roadside tables, cross-arms for hydro poles, shingles, bottoms for six- and eleven-quart baskets, crating, boxes, beds, dressers, vanity tables, baseball bats, liquor cabinets, dining-room suites, neck yokes, whiffle trees, hotel and office fixtures, bars, cabinets, sash and doors, cedar chests and coat racks; the field is indeed large and produces articles from the $400 bedroom suite to the 75¢ peevie handle.

(2) By-products

Sawmill by-products are slabs, edgings, trim and sawdust. For many years these by-products were either burned or sold for handling costs. Presently, however, the demand for them is increasing.

Slabs and edgings are cut into 12, 14, 16 and 18-inch lengths and sold as fuel when they are not used to feed the sawmill boiler. Prices vary at different mills and again between softwood and hardwood. The hardwood slabs because of their better burning quality command a higher price than do the softwood. A comparison of slab prices follows. Prices are quoted per cord, delivered, a cord being a pile 4 feet high, 8 feet long and as wide as the slab length. There is no difference in price for longer slabs, the 12- and 18-inch cords selling for the same price from the same dealer.

Slabs	Mill 1	Mill 2	Mill 3	Mill 4	Mill 5	Mill 6	Mill 7
Hardwood	$3.00		$4.50		$3.25		$3.50
Mixed wood		$2.00	$3.00		$2.25	$2.20	$3.00
Softwood		$2.00		$2.00			$2.50

Sawdust disposal still creates a problem for some millers. It is a fire hazard. Water-powered mills must use care to see that it does not get into the stream and cause pollution. Large areas are needed to handle the volume that accumulates and many man-hours of labour are required to haul and spread it. Though for the most part the use of sawdust and shavings in the past has been confined to fuel supply for steam-powered mills, its value is becoming more widely appreciated, particularly as a domestic fuel or in place of straw for stable and poultry-house floors. It has excellent properties for this latter use and when returned to the land it greatly improves the soil.

(g) Specialty Mills

Specialty mills on the watershed are of two types, those producing dimension stock and those producing basket bottoms.

(1) Dimension stock mills

Dimension stock is lumber which is sawn from particular species for a particular purpose. It is sawn in various widths, lengths and thicknesses according to the buyer's specifications which in turn are dictated by the capacity of the buyer's machinery which converts it into its ultimate form as rulers, heels, chair rungs etc. Because of these specifications as to size of the mill product, more cuts must be made in the log, and the daily board foot production is not as high as it is in mills sawing straight lumber. Also more of the wood goes into sawdust and, because of high grade requirements, slabs and edgings. To compensate the mill owner for this waste and extra sawing the price of dimension stock on a basis of board foot content is higher than that received for lumber and timbers. There is only one mill on the watershed that puts out dimension stock alone, but part of the production of three other mills is of this type.

(2) Basket bottom mills

There are two mills on the watershed sawing basket bottoms, for the common six- and eleven-quart baskets. Poplar and cedar are the two species most used. Basket manufacturers require bottoms to be light and non-resinous. They need not be exceptionally strong. Poplar, though only in fair supply, satisfies these requirements and as it is cheaper than other woods is most favoured. The logs are purchased standing, by the thousand board feet or by the four- or eight-foot cord. At the mill they are cut into bolts which are the length of the basket bottom plus a trimming allowance. The bolts are then sawn, in a vertical position, into slices about one half inch thick. These slices are edged into widths which make either a whole bottom or part of a bottom. They are then trimmed to length. Under ordinary circumstances they must be air-dried before sale.

The high degree of utilization practised in basket bottom manufacture is remarkable. The tops of trees can be used down to a three- or four-inch diameter as these can be sawn and edged into sections which, when stapled together, will make a complete basket bottom. The sawdust from the headsaw, because the bolt is sawn with the grain, is stringy, resembling excelsior, and is used by fruit-tree nurseries for packing seedlings. There are two small slabs on each bolt and these are sold by the cord as fuelwood. The edgings are bundled and sold as kindling.

(h) Product Outlets

The softwood mills produce, with few exceptions, construction lumber. Much of this is sold at the mill to local consumers for farm and other building purposes. Local retail lumber yards buy part of the production. Only a comparatively small amount leaves the immediate area, though individual truckers do buy from the mills and resell as far away as Chatham.

Forty-five per cent of the total hardwood production is sawn by the large furniture factories on the

watershed, and those factories without mills buy some of their lumber from the smaller local sawmillers. It is estimated that at least 50 per cent of all the hardwood sawn by the mills visited is consumed by the furniture manufacturers in Durham and Hanover. About 10 per cent is exported to the United States. The remaining 40 per cent of the hardwood lumber produced on the watershed is sold to other furniture factories, ruler manufacturers, wooden heel concerns and hardwood lumber wholesalers. These are located in Preston, Listowel, Orillia, Owen Sound, Stratford, Waterloo, Toronto and other parts of the Province.

There are two general sources of raw material from the viewpoint of the sawmill operator. These are, (a) timberland owned outright by the operator, or on which he has cutting rights by contract, and (b) open log market purchases. The purchase of logs from these sources can be broken down into five distinct methods. These are listed; the first three apply in source (a) above and the last two apply in source (b).

(1) purchase of entire farms to obtain the woodlot
(2) purchase of woodlot including the land it is on without buying the rest of the farm
(3) contracting the cutting rights to a woodlot
(4) buying logs at the roadside
(5) buying logs delivered to the mill.

A discussion of the five methods of acquiring logs follows:

(1) <u>Buying farms</u>

The outright purchase of entire farms to obtain the woodlot is practised only by the larger mills. Such purchases demand a considerable capital investment, which limits this field to certain operators. If the unwooded portion of the purchased farm is tillable and has good crop-growing properties it may be resold immediately with an agreement whereby the timber operator retains the cutting rights or deed to the woodlot, or, if the land is not suited to general agriculture, it may be rented as sheep or cattle pasture. In cases where

the cleared land is of little value, the most far-sighted arrangement, as practised by one sawmilling and furniture manufacturing concern on the watershed, is that of harvesting the merchantable timber from the woodlot and planting the remainder of the farm to those species of trees recommended by the office of the Zone Forester at Owen Sound.

(2) Outright purchase of woodlots

The practice of taking deed to woodlots is not restricted to any one type of operator. Woodlots are purchased outright by the largest and the smallest of both softwood and hardwood sawmillers. The purchase is made to insure a sufficient supply of logs, as often the quantity of delivered and roadside logs available is short of that required.

When woodlots have been purchased outright, as when farms have been purchased and resold with retention of deed to the woodlot, the sawmiller or log contractor is left after harvest with a bush that has no ready market value as all the merchantable timber has been removed. Sometimes it can be sold to the farmer who owns the adjacent property, but the monetary return for bush of this kind is indeed small. It is therefore felt by some that continued ownership is advisable. As one operator said, "I keep it as a sort of insurance policy for future supply".

(3) Contracting the cutting rights

This is one of the most popular methods of obtaining logs since it usually does not require as large a capital outlay as does outright purchase. The landowner who may not want to sell part of his farm favours this type of transaction and the buyer is not left with an unsaleable harvested woodlot.

As with outright purchase, the contracting of cutting rights involves a cruise of the woodlot by the buyer to provide an estimate of the quantity and quality of standing timber which is followed by an offer of payment on whatever

terms are agreeable to both parties. "Methods of Payment" is further explained in the later text.

(4) Buying logs at roadside

Most farmer-made logs are bought in this manner. The woodlot owner either cuts the logs himself during the winter months or has them cut on a cash or share basis, skids them to a roadside and sells them piled in the skidway. The logs are purchased by the thousand board feet (Doyle Rule), the buyer paying hauling costs to the mill.

(5) Buying delivered logs

Delivered logs form another important source of raw material for the sawmills. Though some mills which own their own trucks do not buy in this manner, others rely entirely upon delivered logs and the majority of mills buy some. Mills which buy both roadside and delivered logs allow a fair price differential to cover the cost of hauling if the log seller wishes to deliver. The mills do not allow more than they themselves would have to spend for the service, but neither do they attempt to profit from their own trucking facilities. For this reason a mill which has its own trucks can usually haul more cheaply than the private trucker; therefore if the log maker does not have access to a logging truck he is, when dealing with a mill which has a trucking service, likely to sell his logs at the roadside leaving the haul to the buyer.

(i) Methods of Payment for Logs

The woodlot owner may receive payment for his timber on a lump sum basis, at a price per thousand board feet on the stump or a price per thousand board feet made into logs.

(1) Lump sum transactions

The lump sum method of payment is used in the purchase of entire woodlots when there is a contract for all or a certain species to a stated diameter, or in the sale of particular trees which have been selected by the owner or the buyer.

A lump sum transaction is based upon a volume estimate by the buyer. As shown under the section on cruising,

the volume estimate of different bidders may vary considerably. As it can be assumed that almost the same basic value per thousand board feet is used by all prospective buyers in setting an offer for the same woodlot, is is obvious that the offer made by the buyer using the highest volume estimate will be the greatest and consequently most attractive to the woodlot owner. The buyer's risk in this type of purchase is reasonably secure because the price per thousand board feet that he uses in making his estimate takes into consideration all the harvesting and marketing risks that experience has taught him to consider.

Log buyers on the Saugeen Watershed are acutely aware of increased and increasing competition for the timber of the farm woodlots. This competition has compelled them to be more accurate in setting their bids. It therefore follows that in this area where keen competition exists between log buyers the law of supply and demand should bring the owner the best market price for his timber. However, to make this law function effectively it is essential that competitive bids be sought from as many buyers as possible. These buyers should represent all the fields of log manufacturing whose establishments are within economical operating distance of the woodlot. The establishments resident on the Saugeen Watershed include sawmills, both privately owned and those belonging to furniture manufacturers, mills which specialize in hardwood dimension stock, basket bottom plants and post and pole operators. The seller is advised to consult the list of buyers of woodland products held by the Department of Lands and Forests at its Zone Office in Owen Sound.

Many of the larger timber operators prefer to purchase their requirements by the lump sum method. The most competent buyers can successfully offer winning tenders and leave themselves the necessary safety margin to take care of the logging chance. Realization on the venture is greater

according to the buyer's ability to carry through operations on a better cost sale ratio than was used in his calculations setting the lump sum bid. The buyer accepts this challenge to his abilities and in the long run hopes that the chance taken proves profitable. It is not always so. Buying logs in skids or delivered to the mill and paying for them at a price per thousand board feet removes the financial risk to the operator of outright purchase and payment by lump sum, but it also removes the chance for the extra margin of profit which is a measure of the ability and accuracy of the stumpage buyer.

(2) Stumpage rate transactions

Selling the standing timber at so much per thousand board feet puts the sale on a volume basis - or what some millmen describe as an arguing basis - and the owner is paid for the volume of timber removed. The buyer may have agreed to cut the entire woodlot or all or certain species to a stated diameter limit. In any case the buyer has to measure the volume removed. In some cases the agreement is on a straight price per thousand board feet, but generally the buyer puts each log into one of two or three grades. The price schedule might show the best type of log to be worth almost three times as much as the poorest grade although the actual volume in the two logs is the same. (More is said about log grades in the following section.)

The woodlot owner seldom knows the intricacies of processing logs into lumber although he frequently owns a scaling stick and often feels that he should dispute the grader's allocation of some logs to the low price category. A dissatisfied log owner who feels that he has been cheated on the measurement of volume or grade of timber removed can, by word of mouth, put the reputation of the buyer in a doubtful light prejudicial to the buyer's business future in the area. To avoid the bad feelings and arguments which may result from payment on a straight volume or volume-grade basis is another reason why buyers prefer to pay a lump sum for their material.

Some buyers will purchase only by the lump sum method of payment but most will consider either the lump sum or volume removed basis. The woodlot owner must decide whether he will do better to accept the lump sum offered, leaving the risk of log grade and volume recovered to the buyer, or to sell at so much per thousand board feet and accept the risk himself.

In the event that he chooses to be paid on a volume removed basis, just what the buyer intends to cut and pay for should be absolutely clear. Only the best trees might be removed and it is possible that only the best logs from these trees might be taken. This leaves the owner with many poor quality logs which he cannot readily sell and with some poor trees standing which he wanted cut. The volume actually paid for might be small and the woodlot owner's total realization on the transaction might be less than he would have received had he accepted payment in a lump sum.

No matter which of these two methods is chosen, a written Timber Sales Contract should cover the transaction. It should set forth all the details necessary as to prices, species, sizes, rights granted to the buyers, limiting dates, times of payment, and so on. There may be considerable difference in contracts depending on methods of buying, standards of measurement etc. It pays to deal with established or reputable firms or buyers in the sale of the woodland products. In many cases the logs are transported long distances to the place of manufacture or the owner is not resident upon his woodland - it is in the interest of both parties to set forth their agreement in a written contract.

(3) <u>Owner-made log transactions</u>

The woodlot owner who has decided to realize not only the value of his woodland product but also the additional labour income derived from its harvest prefers to take payment at a price per thousand board feet for logs placed

skids at the roadway or logs delivered to the mill. Currently sawmills pay from $15 to $25 more per thousand board feet for logs delivered than they do for standing timber. Although the number of farmers doing their own harvesting has been on the increase, due in part to increased quantities of second- and third-growth timber plus the desire for slack season income during the winter months, the present combined output of all farmers is not great enough to supply the needs of the existing sawmills.

It was suggested by one sawmiller that a reason for the relatively small output of the farmer woodlot owner is that, because of the high price of beef and other farm produce, the better farmer is presently too prosperous to be bothered with a small logging operation.

(j) Log Purchase Prices - Log Grades

A woodlot owner may wonder when the sale price at the mill for "select grade" hard maple in two-inch stock is $200 per thousand board feet and at the same time the price he receives for standing maple may average only $60 per thousand for good trees. But he should also note that No. 3 Common is selling for about the same price as he is paid for his standing timber and this grade is not paying the mill its costs. Also select grades represent only a small percentage of the mill run, generally less than 15 per cent in hardwoods. The operator has to handle, manufacture and market large quantities of timber of marginal and submarginal sale value in order to offer to the market the small percentage of high-grade stock which puts the economic picture of the operation in a better light; higher grades must carry the burden of lower grades.

The amount of lumber which can be sawn from a log depends upon the skill of the sawyer, number of defects present, shape of the log, thickness of the boards or timbers sawn and the amount of saw kerf. The defects may be either visible or hidden. Logs are graded on the visible defects, allowance for hidden defects such as those caused by old maple

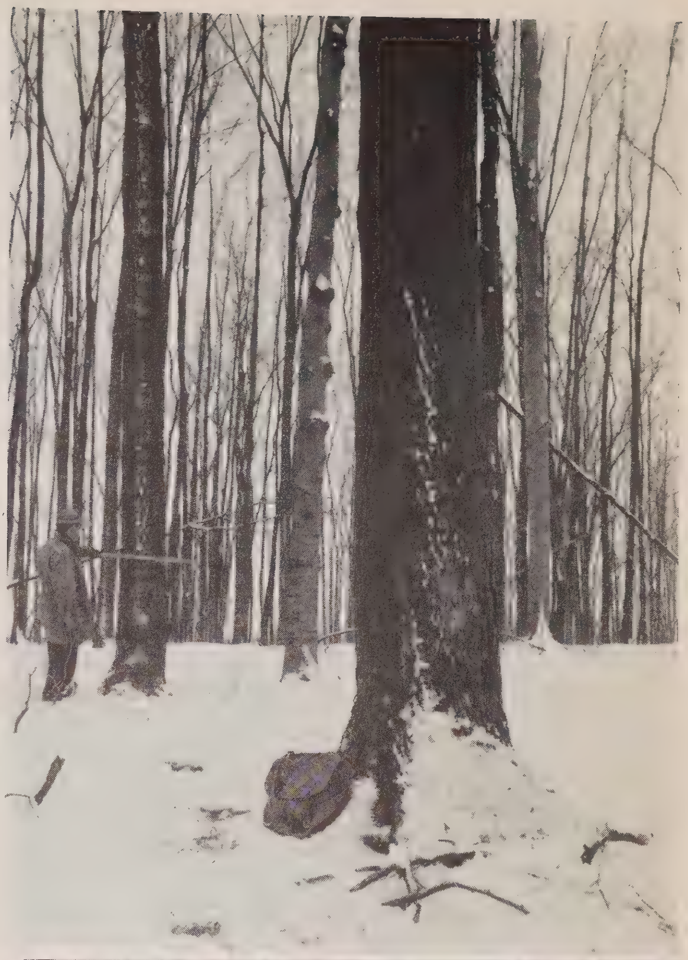
LOG GRADE SPECIFICATIONS

HARDWOODS*					
Grade	Lengths	Diameter small end	Maximum crook	% of gross scale allowable rot, sweep, etc.	Surface requirements on each of the 3 visible faces or sides
Select	12'3" - 16'3"	16" up	2"	10	Clear; no knots or indications of knots
	12'3" - 16'3"	12", 13"	3"	25	Clear entire length
1	10'3"	14"	3"	25	Clear entire length
	12'3" - 16'3"	14"	3"	25	80% clear in 1 cutting
	8'3" - 16'3"	10" up	3"	40	Clear entire length
2	10'3" - 16'3"	10" up	3"	40	2/3 clear in not over 2 cuttings each not less than 3' long
3	8'3" - 16'3"	10" up	4"	40	40% clear in cuttings not less than 3' long

* Note for maple: Select logs cannot have more than 1/3 of diameter and 1's and 2's more than 1/2 of diameter in black heart or mineral streak.

WHITE PINE †					
Select	12'3" - 16'3"	16" up	1"	5	Surface clear; have no knots or red rot, and no indication of knots near surface
1	12'3" - 16'3"	12" up	2"	25	Any number of sound tight knots not over $1\frac{1}{2}$" in diam. No red rot
2	8'3" - 16'3"	10" up	3"	40	Any number of sound tight knots not over 3" in diameter
3	8'3" - 16'3"	8" up	3"	30	Logs suitable for lumber that will not grade up to No. 2 because of imperfections
HEMLOCK †					
Merchantable	8'3" up	8" up	3"	30	No requirement

† Note: No dead hemlock and pine logs will be accepted unless they have at least 14 inches diameter of sound heart wood.



Selective logging. The 21-inch maple in the foreground is blazed for removal while the 16-inch maple in the background has been left. At the smaller size hard maple is putting on its "quality growth".

Some operators do not pay their Grade 1 prices for logs with centre defect, while others do. Maple syrup spiles caused the small dark marks seen on this butt log.

syrup spiles or overgrown limb stubs proving a problem. The effects of the various defects or combination of defects on the grade-volume outrun of the lumber at the mill is not easy to appraise, and only those with considerable experience at the headsaw and at grading lumber can attempt it. Since probable grade output per log is important the buyer considers this when buying stumpage or logs. Generally operators classify logs in at least three grades, and sometimes four, and pay for logs according to these grades.

Sometimes the grading rules are rigid, but in most cases in that area of the Saugeen Watershed under study in the summer of 1951 they were found to vary from flexible to vague, in fact a few buyers did not grade at all but bought at a set price per thousand board feet bush run. However, even with those who have reasonably well defined log grading specifications, the specifications are rarely available in a tabulated form to a log seller. The log buyer simply keeps in mind certain basic principles and grades on his knowledge of what can be sawn from each log. Log grading rules therefore are not only indefinite but also vary from one operator to the next. This lack of standardization, lack of publication and the obscurity of log-grading rules increases the general confusion regarding them to the extent that it becomes extremely difficult, if not actually impossible, for the woodlot owner to compare the log price-grades of different buyers - and a quoted price per thousand board feet actually means very little to the man selling logs. Tables showing a comparison of grades, and prices paid for these grades, by two hardwood operators and two softwood operators are found on the following pages. Consulting the price lists in the table for operators "A" and "B" it appears that operator "A" pays by far the best price for hardwood logs and that selling to him would bring the maximum dollar return. However, upon examination of the grading rules it is found that there are other very important

LOG PRICE LISTS 1951 FOR TWO HARDWOOD OPERATORS WITH GENERAL LOG GRADE SPECIFICATIONS

Prices quoted are those paid per M bd. ft. by Operators A and B for logs delivered to the mill. Roadside logs bring \$5 to \$10 less than these prices. Prices are up \$10 per M bd. ft. above those of 1950.

Species	Grade 1		Grade 2		Grade 3	
	A	B	A	B	A	B
Hard maple	\$90	\$70	\$60	\$50	\$35	\$30
Beech	70	50	45	35	25	20
Elm	75	55	50	40	30	25
Basswood	85	70	55	50	35	30
Birch	75	55	50	40	30	25
Ash	75	55	50	40	30	25
Hickory		70		50		30
Cherry		70		50		30
Hemlock	65	50	40	40	20	25

LOG GRADE SPECIFICATIONS

Grade	Minimum Diameter (Inches)		Minimum Length (Feet)		Knots Permissible	
	A	B	A	B	A	B
1	16	14	12	12	None	Up to 3 small tight
2	12	10	12	8	1 to 2 small tight	No loose
3	8	8	8	8	Several small tight, 2 or 3 loose	Several small tight, 1 to 2 loose

Grade	Diameter of Centre Shake Permitted in a 10-inch Log (Inches)		Diameter of Heartrot Permitted (Inches)	
	A	B	A	B
1	None	1	None	1
2	1	2	1	2
3	3	4	3	4

Grade	Seam Permitted		Crook Permitted	
	A	B	A	B
1	None	None	None	None
2	None	Small straight	None	Up to 10% volume reduction
3	Straight only	Half spiral	Up to 30% volume reduction	Up to 30% volume reduction

LOG PRICE LISTS 1951 FOR TWO SOFTWOOD OPERATORS
WITH GENERAL LOG GRADE SPECIFICATIONS

Prices are those paid by Operators C and D per M bd. ft. delivered to the mill

Species	Grade 1		Grade 2		Grade 3	
	C	D	C	D	C	D
Spruce	$ 70	$70	$60	$50	$50	$30
Balsam	70	70	60	50	50	30
Hemlock	60	70	50	50	40	30
Cedar	60	70	45	50	35	30
Pine	110	90	85	70	60	50

LOG GRADE SPECIFICATIONS

Grade	Minimum Diameter (Inches)		Minimum Length (Feet)		Knots Permissible	
	C	D	C	D	C	D
1	14	16	12	12	3 to 4 small tight	1 small tight
2	12	14	12	10	6 to 8 small tight	3 to 4 small tight
3	7	8	8	8	Over 8 small tight. All logs with loose knots	Not more than 6 small tight nor 2 loose

Grade	Shake Permitted		Heartrot Permitted	
	C	D	C	D
1	None	None	None	None
2	2" for 10" log	None	2" for 10" log	2" in 10"
3	If log volume reduced 30% or more	2" to 3" in 10" log	If log volume reduced 30% or more *	3" in 10"

Grade	Seam Permitted		Crook Permitted	
	C	D	C	D
1	None	None	None	None
2	None	None	None	None
3	No more than half spiral	One straight seam only	30% volume reduction	Slight only

* Although the sawmillers whose grades are listed do not want to accept logs with more defect than is shown by Grade 3, they sometimes feel compelled to do so, particularly Operator D, whose grades are more exacting. Operator C has turned logs away that would not reach his lowest specifications.

factors which will affect the transaction and that price must be correlated with grade. Although operator "A" offers $90 per thousand board feet hard maple of grade 1 quality, the log must be over 16-inch top diameter and have no defects at all. Of all the logs sawn in the district only a small percentage would possess the qualifications necessary to admit them to this grade category. Therefore the best price that will be obtained from operator "A" for the majority of the logs sold to him will be that of grade 2, $60 per thousand. If the logs were sold to operator "B", more of the logs would be in the grade 1 category because his specifications for top grade are not as exacting, some knots, shake and heart rot being allowed. To illustrate these price-grade variations more clearly, five hypothetical 12-foot logs with different defects are listed below in table form and the prices they would command from the two operators are shown.

Diameter Small end	Defects	Price paid per M. Board Feet	
		Operator "A"	Operator "B"
18"	clear	$90	$70
16"	3 knots, otherwise sound	$60	$70
14"	clear	$60	$70
12"	2 tight knots 1½" heart rot	$35	$50
10"	crook (30% volume deduction)	$35	$30

It can be seen therefore that the log seller must, to realize his greatest profit, examine the grading rules and prices of the different buyers and consider which will best suit his particular type of timber - despite the difficulty of following such a practice.

Buyers' needs for timber are different and fluctuate and so the amounts they will pay also vary. There may be special orders or contracts beyond general sales. Such orders might call for concentration on elm of hockey-stick

grade, maple of heel-stock grade and so on. In some cases buyers will pay premium prices for special logs that will satisfy good contracts. In other contracts an order may allow certain defects such as dark heart or sound knots which may not generally be allowed in the sale of the species, and a heavy run of rough logs may be allowed at good prices to satisfy a contract. At another time such rough logs would be of no interest to the buyer. Special prices of this nature should be made known.

A good buyer, in making a stumpage purchase on a per thousand basis by log grade, will walk the woodlot with the owner and try to illustrate the various log grades according to external appearance. In this way the owner is more likely to receive an idea of the probable log-grade run in the sale.

Much of the skepticism in the minds of the woodlot owners toward dealings with log buyers would disappear if there was less obscuring of the grading standards. Some buyers feel that they must say that they operate with open books. Generally this is true. A good way to show this is to make available price lists and general log grade specifications together.

However, as has been brought out in this section, in themselves, published log grade-prices of individual operators are at best only a guide to the seller, who is more often than not unfamiliar with their intricacies.

It is evident therefore that the grading rules must also be standardized if the woodlot log owner is to achieve an understanding of the rules comprehensive enough to enable him to effectively compare the prices offered by different buyers and thereby choose and receive the maximum market price for his logs.

To arrive at a set of volume-grade rules which will be of acceptable accuracy, fairness and clarity presents several problems. The first step, which is to evolve a system

of scaling which will give consistent log volume content is not too difficult. Such a system has been devised and practised by the Division of Timber Management, Department of Lands and Forests, for some time and is laid out in the Manual of Scaling Instructions - but it is based on the controversial Doyle Rule which has, as recently as the summer of 1951, been abandoned by the Department. Nevertheless conversion of the system itself to another more accurate Rule - perhaps the International - is possible. The greatest difficulty lies in creating a system which will give consistent log grade in which allowance must be made for downgrading due to external (eg. knots, burls, scars) and internal (eg. spirral grain, discolouration, mineral stain) defects. The solution to this problem is not at once apparent. One approach to downgrading might be to make an allowance on a percentage basis as is done in reducing log volume for crook. Another might be to reduce grade on a point system based on the visible defects of the ends and sides of the log. Whatever plan is eventually adopted, its evolution will be complex and require a great deal of study. It is therefore recommended that the Authority request the Department of Lands and Forests to conduct a program with the object in view of standardizing hardwood log grades based on defects and how they limit the use to which the log can be put.

5. Local Wood-Using Industries

The sale of the saw log material from the woodlot depends on the mill-operator having sale for the lumber he manufactures. The following study of local wood-using industries has been made to show their manufactured products and species used and therefore their probable dependence on supply from local woodlands.

There are no natural boundaries in the field of manufacturing from wood at which divisions can be made for study. Actually one man turning out ladders in his basement workshop in the evenings would be consuming wood, manufacturing a

PRINCIPAL STATISTICS* OF MANUFACTURING INDUSTRIES IN GREY COUNTY (WOOD-USING INDUSTRIES), 1949

Industry	Establishments No.	Employees No.	Salaries and Wages $	Cost of Fuel and Electricity $	Cost of Materials $	Gross Value of Production $
Sawmills, lumber	39	152	197,373	20,677	466,668	894,333
Sawmills, shingle	3)					
Sawmills, stave and head	1)	16	18,078	1,303	24,120	53,167
Planing mills, sash and door factories	7	38	62,333	5,275	131,201	207,887
Furniture	20	1,609	3,300,559	88,594	2,598,993	6,978,467
Other wood-using industries	9	258	432,325	17,748	459,321	1,211,018
Total Wood Products	79	2,073	4,010,668	133,597	3,680,303	9,344,872
Total All Industries	204	4,714	8,887,015	523,245	15,345,234	30,310,899

* Dominion Bureau of Statistics

product and therefore operating what could conceivably be termed a wood-using industry. In order to make the problem of collecting data not too unwieldy, an arbitrary annual consumption figure of 5,000 board feet per year was chosen and small wood-working enterprises using less than this amount were not studied.

In the area, nine establishments qualified as wood-using industries. Seven of these are in the town of Hanover. All but one manufacture some type of furniture. Four of the nine turn out only, or specialize in, bedroom and dining-room furniture and their products are known nationally. Another four manufacture hotel, restaurant and office fixtures, chairs, cabinets, sash and doors, cocktail tables and metal and wooden kitchen furniture. The exception mentioned, which does not make furniture, produces baseball bats, neck yokes, whiffle trees and peevie handles.

It is difficult to arrive at a figure which would represent the local wood manufacturers' consumption of wood grown on the watershed. The manufacturers have many small suppliers. Some are located within the watershed but obtain part of their log supply from without. Again, some of those mills whose suppliers are outside the watershed obtain part of their log supply from within. Considering those manufacturing concerns who have their own mills, however, and the approximation offered by all the manufacturers, it is doubtful if the watershed supplies more than 10 to 20 per cent of the total wood consumed by the nine resident wood-using industries. This percentage varies among the individual establishments from 0 to 30.

Local species used, in order of quantity, are hard maple, soft maple, soft elm, white and yellow birch, beech, basswood, white ash, black cherry and a little hickory. Maple and birch are in the greatest demand for furniture facing and the local supply, particularly of yellow birch, is not sufficient. Much yellow birch therefore is "imported" from Norther

Ontario and Quebec, as for the same reason is basswood. The United States supplies much of the oak and walnut used and mahogany comes from as far as West Africa and India. Much of the plywood used in the area comes from the veneer plant at Southampton at the mouth of the Saugeen River.

Of the softwoods used, spruce, balsam, hemlock, cedar and white pine are grown locally but, as with hardwood, there is not enough for the needs of the local wood-using industries. Spruce crating is imported from Quebec and Northern Ontario, and Tennessee supplies a great deal of aromatic red cedar.

One of the industries was started only three years ago, but most have been in their present location for a great many years. Several were built in the nineteenth century, one as early as 1864.

6. The Marketing Problem

The marketing problem has three closely related aspects:

(a) The woodlot owner who has merchantable trees that will make sawlogs. The sale of his woodlot increment should be a paying proposition the same as any agricultural enterprise.

(b) The professional or semi-professional sawmill-operator who requires logs that he can mill into lumber on a paying basis.

(c) The ultimate industrial consumer who requires definite quantities of certain species in certain grades in order to carry on his annual manufacturing on a paying basis.

These aspects resolve into getting the woodland products to the mills in sufficient quantity to make their handling profitable to the woodlot owner and the sawmiller, and assuring the consumer a continuous supply of standard grades at fair prices.

In the past the farmer has been at a disadvantage in marketing logs from his woodland. In lump sum sale he must rely on his ability as a trader to strike the best possible bargain with the buyer. He is unfamiliar with methods of

estimating the quantity and value of his merchantable timber; experienced foresters find it difficult to estimate accurately cull and quality when appraising timber, particularly hardwoods, which predominate in the area studied. The buyer has had experience in this field and in addition allows a safety margin on the estimate. Furthermore, operators of small mills and portable mills are often at a disadvantage in marketing their lumber and so are not in a position to pay full value for standing timber. Sale methods involving stripping the woodland ruin the woodlot for decades to come. Sale by set price per thousand board feet removed gives the operator the right to cut all or certain trees above a specified diameter and to take only those portions of the trees he wishes and to pay for only the portion he takes. This pattern of sale removes the uncertainty of the cull and quality factors but introduces the question of how much of the timber cut will actually be taken; it often is high-grading the woodlot and "creaming" the logs of the felled trees. Thus a high price offer per thousand on the stump may bring a lower price to the farmer than the lump sum method. The log scale used in buying standing timber introduces another variable. Opportunity for sharp practice in scaling the felled logs exists, particularly when allowance is made for cull in defective timber. However, in fairness to log buyers it must be said that the majority are not of the type just mentioned.

The professional or semi-professional sawmiller requires assurance of log supply. The lack of interest by many woodlot owners in any form of logging operation of their woodlots forces him to sell the idea of log sale to the owners. To assure log supply to his sawmill he is in many cases forced to buy woodlots in order to plan his milling for the year. Sporadic supply by purchase on the open log market is too indefinite. In buying woodland for a season's milling he may acquire such volume as to remove strong interest in log purchase

in small quantities from individual farmers. The disposition of his cut is often quite a problem. The preponderance of low grades in average hardwood milling, in many cases increased by poor sawing equipment and techniques (especially degrading due to poor piling), make efficient grading and separate piling of the many species sawn a serious problem. The resulting common practice is mixed-grade piling and forces him to deal lumber piles at reduced prices rather than at good prices by specific grades. His established market has considerable dependence upon mutual goodwill with the purchaser.

The industrial consumer most often requires quantities and specific grades in large lots of a carload (approximately 20,000 board feet) and up. He desires well-sawn products of standard widths and thicknesses. Most large consumers must "import" other than local species from large mills which also handle large quantities of well-graded woods which may be sawn locally. It may be more practical from his point of view to pay the extra freight costs involved to be assured of continuous supply of species and grades as required than to "shop around" in an uncertain local supply market.

7. Attempts at a Solution of the Marketing Problem

(a) A Marketing Experiment near Doon

During the winter season of 1948 and 1949 the Department of Lands and Forests in the Galt Zone carried out an experiment in the marking and marketing of timber in an 18-acre woodlot near Doon. The project was initiated by Mr. I. C. Marritt, the District Forester, and the field work was done by Mr. L. S. Hamilton, Zone Forester. The scheme is patterned after a marketing assistance method meeting good success in the State of New Jersey.

The mixed uneven-aged woodlot contained considerable large white pine and red oak. Initial investigations by the Department showed growth stagnation due to overstocking and recommended the removal of certain trees representing the

accumulation of growth over a number of years. Under this condition, removal of selected trees reduces the growth stagnation factor and the remaining trees grow at an increased rate. As growth again slows down, another cropping should take place. This is the simple principle of selective logging - the removal of accumulated growth periodically to keep the stand at a healthy productive growth rate.

Upon explanation of the proposed marketing assistance, the woodlot owner entered into a signed agreement with the Department as a co-operator, agreeing not to sell or allow to be cut any trees except those marked, upon penalty of a nominal fine per thousand for the estimating and marking service of the Department.

The trees were marked with a view to a second marking which would be necessary afterwards to remove weed trees and trees of low value in order to give good growing conditions. Each tree marked for removal was blazed at breast height and below stump height, the stump blaze being branded to detect any unauthorized cutting. The total log scale estimated for the 223 trees marked was 47,600 board feet Doyle Rule. The trees were tabled as to species and diameter on a mimeographed form.

All the estimation data were turned over to a timber agent chosen by the Department. The timber agent entered into written agreement with the owner to

(1) solicit tenders from buyers;

(2) draw up a timber sale contract protecting the owner;

(3) check on cutting operations; and

(4) measure and collect payment for all wood cut before its removal from the property.

The agent was to receive a percentage commission of the gross sale value.

The timber agent mailed the volume estimate sheets to all local log buyers, giving location of the woodlot and inviting inspection of the bush.

The timber sale contract set forth the prices agreed upon for the different species, required that tops be worked into 4-foot wood to be paid for at an agreed price per standard cord, provided penalties for the cutting of unmarked trees, and required that the woods operation be conducted with a minimum of damage to the woodlot.

Prices realized by the owner were much better than the average paid in the area. Prices per thousand board feet Doyle Rule for the standing timber were:

White and red oak..................$62

White ash, soft maple, hard maple, basswood and cherry.........$60

White pine.........................$55

Hemlock............................$45

Beech..............................$30

Fuelwood...........$4 per standard cord

The experiment was considered very successful by all the parties concerned, yielding about 2,000 board feet more than estimated, and the woodlot has been left in fine growing condition with an expected second cut in fifteen or twenty years of 25,000 board feet.

(b) <u>Forest Products Co-operative in New York State</u>

In Otsego County in New York State local interest in forestry, stimulated by critical needs arising from the depression, resulted in the organization of the Otsego Forest Products Co-operative Association at Phoenix near Cooperstown in 1935 as a farmer co-operative under the co-operative corporation laws of New York State. In its certificate of incorporation the objectives of the Association are stated:

> "To promote, foster, and encourage the better care and increased productivity of woodlands, the orderly and efficient marketing of forest products through co-operation to eliminate speculation and waste and to stabilize the marketing of forest products."

A survey covering a radius of 35 miles from Cooperstown indicated about 2 billion feet of merchantable timber, a fair portion of which could be available to the Co-operative. In 1937 a loan was arranged with the Farm Security Administration to construct and operate a farmer-owned processing plant. Since that time this Association has afforded farmers within an increasing radius (now about 50 miles and occasionally up to 90 miles) an opportunity to practise forestry in conjunction with their usual farming enterprises on a basis that assures equitable return from any species and grade of product in whatever quantity offered. The program requires change from the common stripping of woodland and of utilizing only the best trees of a few species, to selective logging and diversified utilization, whereby the forests will be managed for a continuous high-value yield.

Otsego County, in which the centre of the mill-servicing area is located, is not unlike much of Southern Ontario. The county is dominated by dairying; about 62 per cent of the land is used for crops and pasture; 28 per cent is in forest; the remaining 10 per cent is abandoned farmland (reverted to brush), water, roads, marsh, building sites, and so on.

The Association is composed of members and operated by a Board of nine Directors elected by members at an annual meeting. The manager is appointed by the Board and is assisted by an office manager, a complete mill crew, and field-men who handle member contracts and all phases of the field activities.

To become a member a person must be a woodlot owner, must purchase five shares of common stock at $1 per share and must sign the Association's Marketing Agreement. The member thereby agrees to manage his woodlot according to good forestry practices and to sell any sawlogs cut by him for sale to the Co-operative and to accept 5 per cent of the value of his logs in common stock. Members receive patronage dividends.

The Association agrees to assist the owner in applying good forest practices to his woodlot and to publish prices and grading specifications for logs on a delivered-to-the-mill basis and, should it be unable to handle the member's forest products advantageously, to give permission to sell them elsewhere. Lumber needs of members are met at wholesale prices at the mill. By 1941 the Association had a membership of over 600; this had increased to almost 1,100 by the spring of 1950.

The Association's fieldmen will, on request and without charge, cruise a member's woodlot and mark for cutting, telling him the number and volume by species of trees in his woodlot and the physical condition of the stand. The marking viewpoint is to improve the woodlot by removal of mature trees and leave the young and medium-sized trees of commercial species to grow.

The plant of the Association is modern and equipped to get the most out of the log at a minimum of cost and waste. It has a hot log-pond, a modern band mill, a small circular mill, edgers, trimmers, slabsaws, planing mill, small resaw, and mechanical conveyors to the sorting and grading deck. The equipment is powered by electricity and steam. A very important feature of the plant is its battery of dry kilns. There is rail service into the mill-yard.

The mill annually cuts between 2½ and 3 million board feet of lumber, which holds consistently to 66 per cent hardwood and 34 per cent softwood. Mill operation is on a three-day week basis, it being established that full-time operation would too rapidly deplete the timber resources of the area which can be economically serviced. The 12-man crew works the remainder of the week on lumber handling. The daily cutting rate is 20,000 board feet of softwood or 15,000 to 16,000 board feet of hardwood.

The Association publishes a leaflet every two months which is sent to each member. It describes activities and facts about the Association, and farm forestry practices in

general which are of interest to the members. Through it the members are posted on current log prices at the mill by species and log grades and the standard log grades of the mill are set forth in detail. The following is the log-grade specification and log price list effective August 1, 1950.

LOG PRICE LIST

PRICE: (Per M Doyle Scale Delivered at Plant, Phoenix Mills, N.Y.)					
	Species	Log Grade			
		Select	No. 1	No. 2	No. 3
		Price per M Bd.Ft. ($)			
A	Hard Maple Ash Basswood Black Cherry Birch	60.00	50.00	33.00	18.00
B	White Pine	60.00	50.00	38.00	18.00
C	Red Oak Butternut	47.00	37.00	30.00	18.00
D	Beech Elm Soft Maple	35.00	30.00	23.00	18.00
E	Hemlock $39.00 per M for logs, 8,10,12,14 foot lengths $42.00 per M for logs, 16,18,20 foot lengths				

Demonstrating in many ways the economic advantages of co-operative action, the Association has largely overcome many of the obstacles that make intensive forest management on a continuous yield basis impractical without a market that will absorb all classes of products, pay fair prices and accept delivery in small quantities from widely dispersed farm forestry enterprises.

(c) <u>The Lanark County Co-Operative</u>

Mr. W. E. Steele, District Forester at Kemptville in Grenville County, supplied the factual data upon which are

made the following comments on the Lanark County Co-operative for marketing woodlot products.

The Co-operative was set up by a group of woodland owners in the County of Lanark in March 1950. Its objectives are the better management of privately owned woodland to ensure a continuous yield of the best material possible from the forested land of the members through profitable marketing of all the woodland products.

To put the woodland enterprise on a paying basis to the individual it is necessary to market not only the material suitable for lumber manufacture and special products such as veneer, but also the inferior products such as the poorer hardwood species, low-grade hardwood logs of the better species, small softwood products such as cedar posts and poles, and that material removed in improving a woodlot during what may be called sanitation cuttings. It was felt that the advantages of co-operative action by woodland owners in the field of marketing would best solve the problems of the individual, particularly in respect to inferior or small products. Acting as a group rather than individually and through a member active in contacting prospective buyers, they can hope for recognition by the buyers in the area as a stable source of the various woodland products.

The establishment of the Co-operative followed an extensive educational campaign carried on by fieldmen of the Federation of Agriculture, the Department of Lands and Forests, and the local Farm Forum leader. Interest was aroused through moving-pictures, talks at schools, local evening meetings, press releases, radio programs and public speaking competitions on woodlot management. Meetings held at Lanark were attended by officers of the Department of Lands and Forests, representatives of pulp and paper companies, sawmills, and other wood-using industries, and members of agricultural organizations. Gradually a workable plan was evolved and the Lanark Forest Co-operative was set up under a number of directors with Mr. Herb Paul as manager.

Mr. Paul of Lavant, the main force behind the formation of the Co-operative, is an energetic leader of the local Farm Forum, caretaker of the Lanark County Forest, a farmer and owner of several hundred acres of woodland in Lavant Township. As manager of the Co-operative his duties entail the location of markets for the woodland products of the members, arriving at satisfactory price schedules, collection of payment for products, ensuring that products are ready or delivered at the time promised, and advising members on cutting their woodland according to best forestry practices.

By the fall of 1950 membership in the Co-operative was approximately 60, with an increasing interest in its operations prevalent. The membership fee is $5 and in addition the Co-operative takes 5 per cent of the sale proceeds of products handled. The member pledges to supply the quantity of material at the time and place agreed and to practise woodlot management according to conservation principles.

At present the Co-operative has no intention of undertaking a manufacturing endeavour such as a sawmill for lumber or railway ties. Logs are not accumulated at a central point and sorted as to species and a grading standard, but are handled direct from woodland to buyer. The purchaser's measure of the volume, by grade where it might apply, is accepted as the basis for payment on transactions.

An objective of the Co-operative, stated as the better management of privately owned woodland to ensure a continuous yield of the best material possible, is a highly commendable aim. However, the statement embodies a tremendous amount of field work on the part of those capable of advising on the subject of woodlot management. This is a job requiring experienced field personnel. At present, although the Department of Lands and Forests is following this development in marketing with interest and co-operation, it has not the staff of extension foresters to provide the many owners of farm woodland with the guidance that is necessary. If the farm wood-

lot is to assume its place in the economics of the farming enterprise it must be shown that it pays in dollars and cents to the owner. The average woodlot owner cannot afford to carry on practices at a financial loss in the interest of the region or posterity. If, in its infancy, the Co-operative manages to make dollars and cents for its members by the sale of those products generally difficult to market as well as those relatively easy to market, and does the best it can toward field guidance on woodlot management for perpetual yield, then it will have done a lot toward good forestry in its area.

8. Timber Sale Contracts

As an aid to people who are unfamiliar with timber sale agreements, a sample contract is given here. It shows the more important provisions that should be included in a contract for the sale of marked trees to be scaled in the log. Substitute clauses are given for use in other kinds of sales. No single form of contract will suit all classes of sales, but owners of woodland timber should have no difficulty in adopting this contract to their use.

SAMPLE TIMBER SALE CONTRACT

Agreement entered into on this........day of...........
between.........................of.........................
hereinafter called the seller, and........................of
..............................hereinafter called the purchaser.

Witnesseth:

ARTICLE 1. The seller agrees to sell the purchaser, upon the terms and conditions hereinafter stated, all the living timber marked or designated by the seller and all the merchantable dead timber,

standing or down, estimated to be..............board feet, more or less, on Lot......Con..........in the Township of
........................County of.........................and located on a farm owned by the seller and about........miles from..........................

ARTICLE 11. The purchaser agrees to pay the seller the sum of....................more or less, as may be determined by the actual scale, at the rate of.................................. per thousand feet for.. payable prior to the date of removal of material, in installments of..................each.

ARTICLE 111. The purchaser further agrees to cut and remove said timber in strict accordance with the following conditions:

1. Unless an extension of time is granted, all timber shall be cut, paid for, and removed on or before...

2. Saw timber shall be scaled by the.................................log rule, and measured at the...

3. The maximum scaling lengths of logs shall be 16 feet; greater lengths shall be scaled as two or more logs. Upon all logs an additional length of 4 inches shall be allowed for trimming. Logs overrunning this allowance shall be scaled not to exceed the next foot in length.

4. No unmarked timber of any kind shall be cut, except ....

5. Stumps shall be cut so as to cause the least possible waste-stumps of trees up to 16 inches in diameter, not higher than 12 inches above the ground, and those of trees above this size at a distance above the ground not greater than three-fourths of their diameter.

6. All trees shall be utilized in their tops to the lowest possible diameter, for commercially saleable material.

7. Young trees shall be protected against unnecessary injury; only dead trees and less valuable kinds may be used for construction purposes in connection with lumbering operations.

8. Care shall be exercised at all times by the purchaser and his employees against starting and spreading of fire.

.. CLE 1V It is mutually understood and agreed by and ween ae parties heretofore mentioned as follows:

1. All timber included in this agreement shall remain the property of the seller until paid for in full.

2. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by parties to this contract, and in case of further disagreement, with an arbitration board of three persons, one to be selected by each party to this contract and a third to be the Zone Forester or his chosen representative.

In witness whereof the parties hereto have hereunto set their hands and seal this.................................. day of..................................19............

Witnesses:

....
....

The following are sample clauses that should be substituted in the contract when other methods of sale are used In lump sum sales, substitute in Article 1. a descriptive clause, modeled on this one:

All merchantable living trees, except.................. ....which measure 12 inches or less in diameter at breast height (a height of 4-1/2 feet above the ground).

Such provision will reserve the basis of a second crop consisting of the more valuable and rapid-growing kinds of trees and remove all the inferior and slower-growing trees.

The payment clause in lump sum sales should be varied to read somewhat like this:

The sum of.....................dollars...............for said timber, payable prior to the cutting of the material, in installments of................dollars...............each, payable on or before..............................respectively.

WATER

CHAPTER 1

THE RIVER

1. The Watershed and Rivers

The Saugeen River has its source in the south-eastern township of the County of Grey and in the adjacent parts of the Counties of Wellington and Dufferin and flows in a westerly and then a north-westerly direction to the town of Southampton in the County of Bruce, where it empties into Lake Huron. The total area of the watershed is 1,545,57 square miles, lying in five counties, as shown in the following table.

TABLE I

SAUGEEN WATERSHED: AREA BY COUNTIES

County	Square Miles	% of Total Area
Grey	792.36	51.27
Bruce	630.36	40.79
Wellington	100.05	6.47
Huron	16.71	1.08
Dufferin	6.09	0.39
Total	1,545.57	100.00

The name Saugeen, though variously spelled, is the only name by which the main stream of this river has been generally known to white men. Charles Rankin, in running his original line for the Garafraxa-Owen Sound Road in 1837, called it the "Rapid River", perhaps because he was not certain of its identity as "a Saugeen". An Indian authority, writing in 1858, gave the following account of the name and its derivation.

> *"Saugeen, or Suggeen, as some people would have it, I believe, professes to be an Indian word. If so, in order to make sense of it, the letter g should be added at the end of the word, and it would be more proper to write and spell the name S A H G I N G, and the length of its pronunciation

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* Assikinack, Francis. Social and Warlike Customs of the Odahwah Indians. Canadian Journal, July 1858.

should be about the same as that of the word 'sea-king'. It may be rendered in English, the 'outlet', or the 'mouth of a river', though it is not the correct translation. The word is derived from Sahkum, which in Odahwah (Ottawa) signified to come out. In Ojibwa the K is changed into g, and another syllable added, and the word is written and pronounced Sagahum. Sahging is a participial noun, and implies motion as well as an open space, and every river has its sahging, or outlet."

The mouth of the Saugeen River appears on Bayfield's chart of Lake Huron, 1822, where its interest to navigators is indicated in a few words: "River Saugink, 6 feet over the bar it becomes shoal and rapid 200 fms.* within the entrance". In other words, while a vessel might find shelter near the entrance, the river above the rapids was not considered navigable. On his arrival at the mouth of the Saugeen in 1831 the Wesleyan missionary, John Benham, wrote: "The River moves briskly, but I think is navigable for boats". Twenty years later, when settlers began to move into the lands along the lower parts of the river, many of them rafted down the river from Buck's Crossing (Hanover) or from Walker's (Walkerton), but travel up stream was limited to short-range or emergency journeys in light canoes. In 1851, Alexander Vidal, Provincial Land Surveyor, reported the observations that he had made in the course of his survey of the Township of Saugeen:

"On arriving in the River, I immediately made the attempt to ascend it with the boat, and by great exertion got above the 'Indian Rapids'; but learning that it would be impracticable to proceed as high up with her as I required, on account of the rapids and shallows, I purchased a canoe for transporting provisions, camp equipage, and instruments, and then went on foot, the men towing the canoe; proceeding in this manner we ascended the Saugeen to the junction of Greenock (or Mud) River...this (Saugeen) River is upon the average about 4 chains (264 feet) wide, its depth varies from 3 to 10 feet, at its ordinary height, but it is subject to sudden risings, and in the opening of the Spring when partly blocked up by the ice, is often 4 or 5 feet higher. ...the River has many shallows and rapids, occurring at intervals of half a mile or a mile; in these places its beds formed entirely of stones, and many of them, being of large size, present a serious obstacle to the passage of the rafts etc. which are ordinarily used in descending the River.... By the removal of the large blocks of stone which are found in the channel (and which now constitute the chief obstacle to the passage of

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* 1,200 feet. The fathom (fm.) is used here as a unit of lineal measurement.

the River), and by the construction of a Tow-path along its banks, it might be rendered navigable for barges, scows, or other flat bottomed vessels of light draft;... As to the practicability of rendering it navigable for steam vessels up into the interior, even though combining the lightest draft of water with the greatest power of machinery, I am decidedly of opinion that it cannot be done, the Rapids being too great for them to surmount."*

While Vidal was engaged in the survey of the Township of Saugeen, another surveyor, Robert Lynn, was laying out the Town Plot of Southampton, including the "Reserve for the Harbour, Canal Basin and Piers". A three-day storm of wind and rain, at the end of October 1850, compelled him to regard this part of his survey as effort thrown away. On November 2, 1850, he noted in his diary:

"Explored the Mouth of the River after the Rain-Storm and found the Gravel & Sand Bar changed and above Surface of the Lake, for several rods, and other parts of the Bar covered with only 6, 8 & 10 inch of Water, Resounded the Lake in the Mouth of the River, and found that the Bars shifted, enlarged in places and other parts diminished, By the changeing of the Winds etc, examined the Mouth of the River, and came to a candid conclusion that the Mouth of the River Saugeen were Impracticable for making a permanent Harbour, at any reasonable expence."†

Some further particulars of the character of the river are set forth in a Directory of the County of Grey, published in 1865. In spite of Lynn's unfavourable report on the practicability of making a harbour, the account given in the directory shows that the attempt had not been abandoned.

"The Saugeen, though not a navigable river, is one of the three or four larger streams found in the Western part of Upper Canada... Its course is very devious; from its source to Walkerton is about 40 miles in a direct line, and from that town to the mouth of the river is but little over 30 miles direct, making 70 miles for the course of the river; yet, from its many windings, it must flow over 100 miles. The Saugeen is remarkable for its many branches. It has no fewer than five large tributaries, some of them dignified with the appellation of 'Rivers'. In the County of Grey, on the main stream, are the villages of Priceville, Durham and

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* Survey Records, Ontario Department of Lands and Forests. Original Notebook No. 1711.

† Survey Records, Ontario Department of Lands and Forests. Original Notebook No. 1764.

Hanover; on the South Fork (the so-called 'Maitland' of former days), are Cedarville, Mount Forest, Ayton and Neustadt. The Saugeen and all its numerous branches present an almost unlimited number of water-privileges; not a tithe of which are as yet used for manufacturing... At the mouth of the Saugeen, a pier has been projected into the Lake, which not only gives shelter to vessels entering, but by narrowing the channel, tends to deepen the water over the Bar. The depth, however, is not great, and large vessels do not often come into the river. Half a mile up from the mouth, swift water is reached."*

The principal tributaries of the Saugeen River are the North Branch, the Rocky Saugeen, the Beatty Saugeen, the South Branch, and the Teeswater River. The North Branch appears always to have been so called; the others have, from time to time, been known by other names.

In his survey of 1837, Charles Rankin refers to the Rocky Saugeen as the Fox River and to the Beatty Saugeen as the Deep Gully River. These names, along with that of Rapid River for the Main Saugeen, appear never to have gained general currency.

Rankin, presumably on the advice of his Indian guides, took the South Branch to be "the Southern or Main branch of the Saugin". When, in 1841, John McDonald was instructed to complete the work that Rankin had begun in 1837, a mistake was introduced that persisted through more than twenty years, for McDonald's Indians advised him that the river he crossed in the north-west corner of Arthur Township was the Maitland. "And so widely has the error taken root that in the Map of Upper Canada, given in Chewett & Co.'s 'Canadian Almanac' for 1865, the river goes from the South corners of Egremont and Normanby, where Mount Forest <u>ought</u> to be, galloping away towards Goderich! - the old error again repeated."† Mount Forest, that had earlier been called Maitland Hills, was incorporated as a village in 1865, its

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* Smith, W.W. Directory of the County of Grey, pp. 281-282. 1865.

† Smith, W.W. Directory of the County of Grey, p. 148. 1865.

new name reflecting the correction of the "old error"; and it is probable that at least along the banks of the stream concerned, the South Branch was at last properly identified and fittingly named.

The branch of the Saugeen now known as the Teeswater River was called by the Indians the Ah-ta-yahko-sibbi (Drowned Lands River), a name that the white pioneers corrupted to Yokasippi. To the early settlers it came to be known as the Mud River, and many called it (from the township through which it flowed) the Greenock River. In 1850 Allan Park Brough, surveying in Greenock Township, observed that "those flats on the East side of the Ahshushkisibi will, when cleared, make very good Meadow ground", and entered in his field notes: "Meet the edge of the Ahshushkisibi or Muddy River". In the following year, 1851, Brough referred to this stream as "a large tributary which I have named the Teeswater". For many years, the homelier name of "Mud River" persisted, but official usage ultimately prevailed, and the name "Teeswater" is now, after more than a hundred years, the only name generally applied to the branch in question. Brough did not state his reason for his choice of name; the original Tees forms a part of the boundary between Durham and York in England.

The watershed is roughly a rectangle lying due east and west, measuring about 50 miles east and west and 31 miles north and south. It is drained by the Main Saugeen, five major tributaries and numerous smaller ones. The drainage areas of these are as follows:

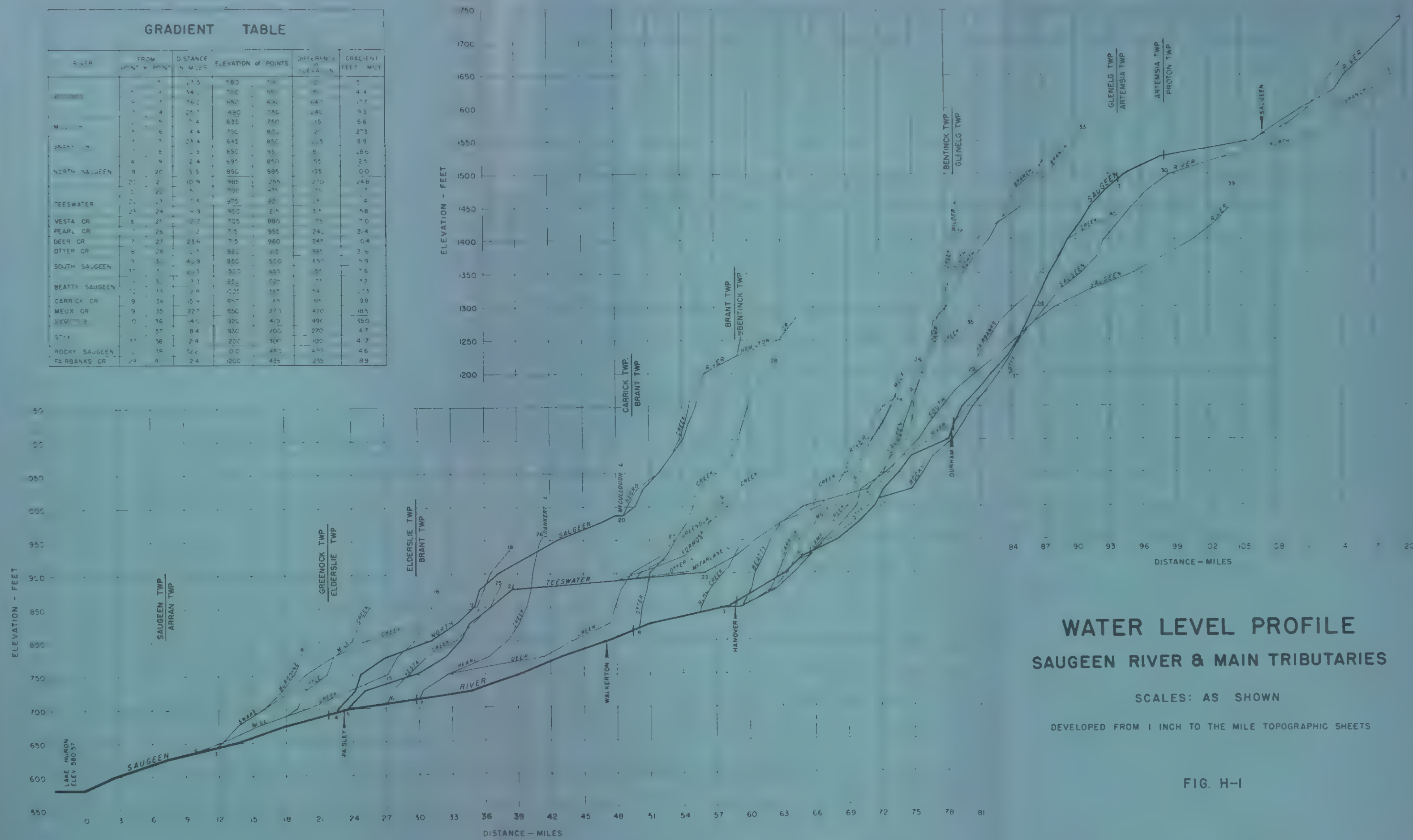
TABLE H-2
DRAINAGE AREA, RIVER AND TRIBUTARIES

Stream	Drainage Area Square Miles	% of Total Area
Main Saugeen River	655.35	42.40
North " "	102.45	6.63
Rocky " "	110.73	7.16
Beatty " "	100.71	6.52
South " "	312.09	20.19
Teeswater River	264.24	17.10
Total Area of Watershed	1,545.57	100.00

The Main Saugeen from the headwaters to its mouth is about 120 miles long, has a total fall of about 1,150 feet and an average gradient of 17.9 feet to the mile. Fig. H-1 shows the water level profile of the river and its tributaries and also a table showing their length and gradients.

GRADIENT TABLE

River	From Point	to Point	Distance in Miles	Elevation of Points		Difference in Elevation	Gradient Feet/Mile
	[illegible]	[illegible]	[illegible]	580	[illegible]	[illegible]	5
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	4	[illegible]	490	730	240	9.3
[illegible]	[illegible]	5	[illegible]	635	750	[illegible]	6.6
	[illegible]	6	4.4	750	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	7	[illegible]	645	850	[illegible]	8.9
	[illegible]	8	[illegible]	650	[illegible]	[illegible]	[illegible]
	4	9	2.4	[illegible]	850	55	2.5
NORTH SAUGEEN	9	20	3.5	850	985	135	0.0
	[illegible]	2[illegible]	10.9	985	[illegible]	[illegible]	[illegible]
	5	[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]
TEESWATER	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	24	[illegible]	[illegible]	[illegible]	[illegible]	5.8
VESTA CR	6	[illegible]	[illegible]	705	880	[illegible]	7.0
PEARL CR	[illegible]	26	[illegible]	[illegible]	955	[illegible]	[illegible]
DEER CR	7	27	23.6	[illegible]	960	[illegible]	[illegible]
OTTER CR	8	28	[illegible]	[illegible]	[illegible]	[illegible]	3.6
SOUTH SAUGEEN	[illegible]	[illegible]	[illegible]	850	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BEATTY SAUGEEN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CARRICK CR	9	34	15.4	[illegible]	[illegible]	[illegible]	9.8
MEUX CR	9	35	22.7	850	[illegible]	420	18.5
[illegible]	[illegible]	36	[illegible]	920	[illegible]	490	35.0
[illegible]		37	8.4	930	[illegible]	270	4.7
	[illegible]	38	2.4	[illegible]	[illegible]	100	4.7
ROCKY SAUGEEN	[illegible]	39	[illegible]	[illegible]	[illegible]	470	4.6
FAIRBANKS CR	29	4[illegible]	2.4	1200	1435	235	8.9



WATER LEVEL PROFILE

SAUGEEN RIVER & MAIN TRIBUTARIES

SCALES: AS SHOWN

DEVELOPED FROM 1 INCH TO THE MILE TOPOGRAPHIC SHEETS

FIG. H-1

CHAPTER 2

FLOODS (1837-1951)

The Methodist missionary, John Benham, who established himself in 1831 on the north bank of the Saugeen River, a little over a mile from its mouth, was careful to select a site for his house on the high bank that rises at that point some thirty or forty feet above the flats that border the river. Without making any mention of floods, he relates only that he chose the site for its convenience.

> "The following day we went in search of a convenient place for a home, and found one which suits us very well, on a hill near a flat of two or three hundred acres, about one hundred of which has been cultivated, and is now a rich meadow... The situation is very pleasant and undoubtedly healthy, as it is near the shore of this rapid river and about a mile from the lake."

From observations recorded during the ensuing century and a half, it is apparent that the flats to which Benham refers were subject to flooding in all but the tamest of spring break-ups.

The first flood on the Saugeen of which any record has been found occurred in 1837. In that year the surveyor Charles Rankin was running the line for a proposed road from Garafraxa to Owen Sound (which was never opened) when he was delayed in his crossing of the Saugeen by high water. He arrived at the south bank of the river, at a point about three miles west of Durham, on the 8th of June, 1837, after two days of continuous rain, and entered in his diary:

> "Ran N 9° W 2 miles to a large river or stream, suppose the main branch of the Saugine, flooded so as to be impassable on the line, and from the nature of opposite (North) shore a broad flat, deeply inundated, unfit for road. Encamped a little way down the river where we find it possible to pass it."

Rankin's only concern was with the delay the flood caused in his work, and he felt no necessity to record the depth of the inundation that he observed. It is of special interest to note, however, that this flood took place in June, and

and not at break-up time, and that it occurred before any of the land in the upper part of the watershed had been cleared.

For the next twenty years or so on the Saugeen, the government surveyors were about the only people who kept official records of day-by-day events. The surveyor, however, made notes of only those events that directly affected his work, and for this reason does not always tell us the details that, to a later generation, appear to be the most important. Thus, in October 1850, J. S. Dennis, surveying on Deer Creek, near the present Elmwood, noted three days of rain, and then: "Fri., Oct. 4, Edge of Creek, swollen with recent rains, 60 links (40 feet) over, rapid current..." Unfortunately, it is not possible to turn to other diaries covering the same few days and find confirmation of this entry, or details of high water on other points on the watershed; this one brief glimpse of an obscure corner of the region is all that is known to exist.

The next recorded flood took place in April 1851, and has been described, not by a surveyor, but by a young man who was on his way to the "Saugeen Country" to settle. David Kennedy, in a book of reminiscences written in 1902, tells how in 1851 he built a scow at "Buck's Crossing" (Hanover) to carry himself and several others down the river. When the party were at last ready to set out, they encountered an unexpected delay. The river rose in flood so high as to prevent their passing their scow under the bridge at "Walker's" the present Walkerton. As the bridge was built twenty feet above "low-water level", it seems that this flood must have been nearly that height above normal; the high water persisted from the 10th to the 13th of April.

A second flood in the same year took place on June 10, but was noted only on the Mud River (Teeswater), where the surveyor George McPhillips "was stopped by Mud River the water being high on account of the late rain". This does not appear to have been a serious flood.

The flood of June 23 to 25, 1851, was the third in that year. This flood was noted by two surveyors, Robert Walsh and George McPhillips. Like that of the 10th, it followed two days of "heavy Rain". Walsh, surveying in Greenock Township, says:

> "June 21 - heavy rain all night...
> June 22 - heavy rain, continued all night...
> June 23 - swamps covered with water; showery all day, and during the night...
> June 24 - Tees Water deep and rapid from the great flood.
> June 25 - The River much swollen."

McPhillips was at that time surveying in the neighbouring township of Elderslie, on the banks of the Main Saugeen. On June 23 he wrote: "Saugeen River very high, seldom known to rise so high in Summer". His observation carries the suggestion that a rise of similar proportions in the spring would not have been so unusual.

A flood took place in the vicinity of Hanover in May of 1852, when John D. Daniell was surveying in the nearby township of Carrick. On the 11th of May he records that the Main Saugeen was "much swolen; Crossways all destroyed by the floods". And on the 15th: "Could not cross the River, water was so deep at the Time".

After 1852, there is a period of ten years concerning which no records of floods on the Saugeen are available. It does not necessarily follow that there were no floods.

The Toronto Globe of April 25, 1862, quotes from the Walkerton Herald an account of a flood near that town.

> "It was much feared that the bridges would not be able to withstand the force of the current. At Traynor's bridge in the township of Brant, a large jam, composed of hewed lumber and whole trees, gathered in spite of all efforts to disperse it, and on Friday night (April 18th), the whole structure gave way before the immense pressure, and started down the stream... The bridge commonly known as 'Crispin's' has also been carried away."

At the same time, the South Branch at Mount Forest was described as being in a state of "terrible freshet, destroying mills and other valuable property". This is the first time

that mention is made of any serious property damage; it marks the beginning of a tendency to measure the severity of the floods, not by the height to which the waters rise, but by the value of the property they destroy.

The flood of March 17, 1868, must have been of unusual severity. The Toronto Globe reported that the lower portion of Paisley was "almost entirely covered by water", and that the Saugeen and the Teeswater had risen "five or six feet higher than the oldest settler remembers having seen them", the waters flowing over the counters in some of the stores. Valentine's dam, on the Teeswater, was slightly damaged. It is probable that some damage was done at other points on the river, but reports are lacking.

Again, in 1869, the freshet of March 30 is reported only from Southampton, though it must have been felt at other points as well. According to the Toronto Globe, "the bridges on the Saugeen River have been carried off by a freshet, and the only way travellers can now get to Southampton is either by Port Elgin or through Arran, via Stack's Corners". At the time of report the river was still rising; but the next few issues of the Globe have no further mention of the flood that was "expected". There was, however, a second flood in 1869, when the South Branch was in freshet on April 22 and "nearly all the mill-dams" in the neighbourhood of Mount Forest were carried away. Yeoman's dam at Mount Forest was one of those destroyed, and in its fall it carried away one of the piers of the bridge across the Owen Sound road, endangering the whole bridge; but the bridge was not destroyed.

The next severe flood on the Saugeen occurred in 1872. On April 9 of that year a bridge over the river near Port Elgin was carried away; a number of houses in Southampton were destroyed; and a boom of three thousand logs at Walkerton was lost.

The April flood that occurred in the next year must also have been severe, but the report of it is meagre

and is limited to the vicinity of Durham. It was reported on April 17, 1873, that "Mr. Purdy's mills, in the township of Glenelg, on the Saugeen River, and Patterson's mill-dam, in Durham, have been carried away".

In the winter of 1882-83, there was an unuaual accumulation of snow, which resulted in great floods along the Teeswater River during the ensuing spring, with some damage in the village of Pinkerton. Evidence of these floods was submitted in the course of an action for damages brought by Pinkerton against the Township of Greenock in 1906, and is referred to in the official report of the trial; but no details of the damage are given.

A severe flood took place at Walkerton on the 24th of February, 1891, when, according to a report to the Toronto Globe, "the new iron bridge recently erected at the Young street crossing" was carried away. "The bridge was carried away bodily, and now rests on the bottom of the river a hundred yards from its former position."

The Toronto Globe of March 17, 1913, made reference to a flood at Durham in 1893, but did not give the exact date, stating only that it had been caused by an ice jam. No other reference to this flood has been found.

In the spring of 1895, there was again a flood at Pinkerton of which complaint had to be made to the Township of Greenock. The circumstances were reviewed in the course of the trial in 1906: "A number of witnesses speak of there being un unusually heavy fall of snow during the winter of 1894-5, and that in the spring of the latter year the freshet was very high". In similar manner, evidence was given of flooding suffered by the Village of Pinkerton in the spring of 1904 - "the snowfall preceding the flood of 1904 was the greatest in many years, and the freshet was of an unusual character" - and again in 1905 - "the freshet of 1905 was unusual by reason of the quick melting of the snow, causing the Teeswater and its tributaries to fill up with extraordinary

rapidity". Of the four floods referred to in the report of the Pinkerton-Greenock trial in 1906, no contemporary accounts have been found.

A severe flood in 1907 was reported from Southampton. On March 22 of that year, "Denny's bridge, on the Saugeen River, two miles east of here, was carried away by the ice". Fears were entertained for the safety of the Victoria Street bridge; and the Saugeen Electric Light Company's plant, which supplied light to Southampton and Port Elgin, was damaged and put out of service.

The Toronto Globe of April 18, 1908, published a photograph of a flood scene, with the caption (undated): "Spring Floods at Mt. Forest". Nothing further is known of this flood on the Saugeen, but, as there were floods at about the same time on the Maitland and the Bayfield Rivers, it seems likely that the Mount Forest freshet took place not many days before the publication of the photograph. There is no indication of any damage done.

There was high water on the Teeswater on March 22, 1910, but no report of any damage to property. The "swollen condition of the river and the strong current", however, were the cause of the drowning of three women who attempted to cross the Teeswater half a mile above Grant's Bridge, at Semple's farm; "the boat was swept down the river and overturned before they had taken hold of the oars".

The flood of April 7, 1912, was referred to as the "greatest flood in forty years". Great damage was done at Durham, Paisley and Southampton. At Durham, the Canadian Pacific Railway bridge collapsed in the sight of hundreds of spectators. Streets were flooded in Walkerton. At Paisley, residents had to be rescued from their homes by boat, two mill dams were swept away. Mill dams at Pinkerton and Lockerby were badly damaged. Two large bridges over the Saugeen at Southampton collapsed, and the electric light plant was again put out of commission. "All the bridges on the Saugeen River

are threatened with destruction, and there has been great destruction in all the towns along the river."

On March 16, 1913, the Saugeen was once more on the rampage; the only report of damage was from Durham. There the dam of McGowan's mills was swept away, causing a loss of $4,000; and an ice jam lodged against the Canadian Pacific Railway bridge, endangering that structure. The jam backed the waters up until they found a new outlet by flowing through the streets of the lower town at Lambton Street, crossing Main Street several inches deep and flooding many cellars.

From 1913 on there follows an interval of 13 years during which no accounts of floods on the Saugeen are available: whether any floods occurred in these years is not clear.

The flood of April 25, 1926, was one of the worst on record, at least in Hanover, where estimates of the damage to the dam alone ran as high as $100,000. The Toronto Globe carried a Hanover dispatch dated April 26:

> "The damage from floods in Hanover caused by the rising waters of the Saugeen River during yesterday and today will probably exceed $150,000. The big dam owned by the Canada Cement Company here broke away yesterday, while the two bridges in the vicinity were also swept away. One bridge was situated at the Bruce-Grey County line, just outside the town limits, and the other between Hanover and Durham. Damage to property in the flooded section of the town will also amount to a considerable sum."

The Stratford Beacon-Herald of March 16, 1929, reported high water at Walkerton, but no serious damage done. Three weeks later, on April 6, Mildmay and Neustadt were among the communities that were hit by the "worst floods in all their history". On the 7th, Mildmay was recovering from the floods, and estimating damage in the village at approximately $100,000. Dams and bridges were swept away, factories and dwellings collapsed, and sawmill owners lost heavily through timber being washed into the river. The dams at Cargill and Pinkerton were reported to be the only ones left standing on the Teeswater River. "A number of bridges in Brant were swept out yesterday." At Neustadt the damage was estimated at

On March 17, 1948, the Saugeen River flooded part of Walkerton, doing considerable damage. This shows conditions at the intersection of Durham and Jackson Streets.

The local press was also inundated by the rampaging Saugeen River.

$75,000. The water flooded all the stores on Main Street and several homes. One brick dwelling collapsed, and the family had a narrow escape from death. At the same date the Canadian National Railway reported fifty bridges, large and small, in need of repair in the vicinity of Hanover and Bentinck Township.

A February flood in 1932 was severe in the vicinity of Southampton and Port Elgin, but was not widespread. On the 13th of that month

> "The Saugeen River went into a flood stage, broke through the milldam, and carried away part of the old grist mill operated by Mrs. Sarah Bell. The mill is a Port Elgin landmark, which has withstood time and tempest...Some of the streets of Southampton are flooded, and men are working hard endeavoring to turn the rushing water away from the town. Many cellars are flooded."

In 1937, Silver Creek at Walkerton was in flood on the 10th of February, but no serious damage was done. The very severe floods that devastated parts of London in 1937 had no counterpart on the Saugeen. No floods were reported there during the month of April in that year.

Then follows a period of eight years without any known reports of floods on the Saugeen. The next flood was apparently that of July 1945, when the river at Durham "rose 8 feet in two hours", but seems to have caused no damage. The floods of April 1947, however, were both more severe and more general. On April 11, 1947,

> "a four-block area in Walkerton was flooded by the Saugeen River...A boat was used to navigate the one and a half block section of the main street which was under water. Cellars of all stores along the street were flooded. The Saugeen flood tied up the Canadian National Railways line between Hanover and Neustadt."

The water at Walkerton was eight feet above normal.

In 1948, Walkerton was again flooded, and several families had to be removed from their homes. Pumps had to be used to keep water out of the telephone exchange. On March 21 the village of Paisley was flooded, the water being fifteen feet above normal; twelve families had to leave their homes. Both Southampton and Paisley reported heavy damage.

Jackson Street looking north toward the C.P.R. station.

Colbourne Street, Walkerton, looking north from Durham Street toward the C.P.R. bridge.

At Hanover, Walkerton and Durham, there was serious flooding by the Saugeen River on the 23rd of December, 1949, but actual damage was limited to the flooding of some basements in Walkerton.

In April 1950 another flood took place, only slightly more severe than that of the previous December. On April 5 Paisley reported fourteen homes surrounded by water. At Walkerton, three factories were forced to close, and fifteen houses were surrounded. Highway No. 4 was closed by floods near Hanover. And on the same date the Canadian National Railway had to suspend service between Neustadt and Hanover because of "water over the rails".

The floods at Walkerton were by now coming to be almost an annual event, and a flood on the 30th of March, 1951, occasioned no great excitement. It was not a severe flood, and the river rose only four feet above normal. The year 1951, however, was to bring to Walkerton its second flood of the year, and this one rather more serious. On the 26th of April both Walkerton and Hanover had their streets flooded, though actual damage was not extensive.

According to the Chesley Enterprise, on March 20, 1952, the spring break-up came on the Saugeen, and the ice "went out" without causing any damage.

In the course of the 116 years that have elapsed since 1837, there are well-authenticated records of 36 periods of high water of varying degrees of severity. For the purpose of this report, these have been classified into four categories, shown by decades, as follows:

Period	Sharp Freshet	Heavy Flood	Severe Flood	Very Severe Flood	Totals
1831-40		1			1
1841-50	1				1
1851-60	1		3		4
1861-70			4		4
1871-80			2		2
1881-90		1			1
1891-1900		2	1		3
1901-10	1	3	1		5
1911-20			2		2
1921-30	1			2	3
1931-40		1	1		2
1941-50	1	2	2		5
1951-	2	1			3
Totals	7	11	16	2	36

There is in these data no indication of a tendency toward either increased frequency of floods or increased severity. There is a strong probability that in the earlier decades of the period under consideration some floods passed without being either observed or recorded, and that the improved news services of the more recent decades had left few if any floods unreported. That the later floods have in some cases occasioned greater property damage than did the earlier ones is the result of the increasing value of the property exposed to flooding, rather than to the increased severity of the flood or to the height to which the waters have risen.

The available records of flood damage on the Saugeen River do not provide a proper basis for estimating the extent of the property damage done. Even in the case of floods which appear to have been fairly widespread, the published reports do not, as a rule, tell of conditions in more than two or three centres of population, and more often than not, even in those centres that are reported in most detail, make no attempt at estimating the losses. When such estimates are included in the news report, the figures are spectacular: $150,000 at Hanover in 1926; and $100,000 at Mildmay in 1929; and $75,000 at Neustadt in 1929. In the face of the known range of variation of the severity of floods, it is not possible to use the estimates of losses in two floods in three places as a basis for estimating the total losses in thirty-six floods over the entire watershed. One thing seems clear: that even in the worst years of flood, the published figures do not include all the losses incurred. In other words, even in those years when spectacular losses have been announced, the actual totals of the losses caused by the floods have been in excess of the published amounts.

CHECK LIST OF SAUGEEN FLOODS

1837 - June 8 Survey diary of Charles Rankin. Main Saugeen, near confluence with Rocky Saugeen. Heavy flood.

1850 - October 4 Survey notes of J. S. Dennis. Deer Creek, near Elmwood. Sharp freshet.

1851 - April 10-13 David Kennedy, "Pioneer Days", page 18. Estimated seventeen feet above low-water level at bridge at Walkerton. Severe.

June 10 Survey diary, George McPhillips. Mud River (Teeswater) too high to cross. Sharp freshet.

June 23-25 Survey diary, Robert Walsh. Teeswater River in Greenock Township. Also survey diary of George McPhillips. Main Saugeen in Elderslie Township. Severe.

1852 - May 11-15 Survey diary, John D. Daniell. Main Saugeen at Hanover, and south of Walkerton. Severe.

1862 - April 18 Toronto Globe, April 25, quotes from Walkerton Herald. Main Saugeen, near Walkerton. Also Toronto Leader, April 26. South Branch, at Mount Forest: "a terrible freshet". Severe.

1868 - March 17 Toronto Globe, March 23. Main Saugeen and Teeswater River, at Paisley. Severe.

1869 - March 30 Toronto Globe, March 31. At Southampton, "river rising rapidly", bridges destroyed. Severe.

April 21 Toronto Globe, April 23. South Branch, near Mount Forest. Severe.

1872 - April 9 Toronto Globe, April 11. Main Saugeen, at Walkerton, Port Elgin and Southampton. Severe.

1873 - April 16 Toronto Globe, April 18. Main Saugeen, near Durham. Severe.

1883 - Spring, date not given Ontario Weekly (Law) Reporter, Vol. 8 (1906), page 970. Floods in 1883, along the Teeswater. Heavy flood.

1891 - February 24 Toronto Globe, February 26. Main Saugeen, at Walkerton. Severe.

1893 - Spring, date not given Toronto Globe, March 17, 1913. "A flood from the same cause" (ice jam) "occurred in 1893." Main Saugeen, at Durham. Heavy flood.

1895 - Spring, date not given Ontario Weekly (Law) Reporter, Vol. 8 (1906), page 968. Teeswater River, at Pinkerton. Heavy flood.

1904 - Spring, date not given Ontario Weekly (Law) Reporter, Vol. 8 (1906), page 968. Teeswater River, at Pinkerton. Heavy flood.

1905 - Spring, date not given Ontario Weekly (Law) Reporter, Vol. 8 (1906), page 968. Teeswater River, at Pinkerton. Heavy flood.

1907 - March 22 Toronto Globe, March 23. Main Saugeen, at Southampton. Denny's bridge carried away. Severe.

1908 - Spring, date not given Toronto Globe, April 18. Photo, caption: "Spring Floods at Mount Forest". Heavy flood.

1910 - March 22 Toronto Globe, March 23. Teeswater River, near Teeswater. Sharp freshet.

1912 - April 7-8 Toronto Globe, April 8 and 9. Main Saugeen, at Durham, Walkerton, Paisley and Southampton. Severe.

1913 - March 16 Toronto Globe, March 17. Main Saugeen, at Durham. Severe.

1926 - April 25-26 Toronto Globe, April 27. Main Saugeen at Hanover. Very severe.

1929 - March 15 Stratford Beacon-Herqld, March 16. Main Saugeen, at Walkerton. Sharp freshet.

April 6-7 Toronto Globe, April 8. Teeswater River, Otter Creek, South Branch, widespread damage. Very severe.

1932 - February 13-14 Toronto Globe, February 15, Mill Creek, near Port Elgin. Severe.

1937 - February 9 Toronto Globe and Mail, February 10. Silver Creek, at Walkerton. Heavy flood.

1945 - July 15 Toronto Globe and Mail, July 17. Main Saugeen, at Durham. Heavy flood.

1947 - April 11-13 Toronto Globe and Mail, April 12 and 14. Main Saugeen, at Walkerton; and South Branch, at Neustadt. Severe.

1948 - March 21 Toronto Globe and Mail, March 22. Main Saugeen, at Walkerton, Paisley and Southampton. Severe.

1949 - December 23. Toronto Telegram, December 23. Main Saugeen at Durham, Hanover and Walkerton. Heavy flood.

1950 - April 4-5 Toronto Globe and Mail, April 6. Main Saugeen, at Hanover, Walkerton and Paisley. Heavy flood.

1951 - March 30 Toronto Globe and Mail, March 31. Main Saugeen, at Walkerton. Sharp freshet.

April 25 Toronto Globe and Mail, April 26. Main Saugeen, at Walkerton and Hanover. Heavy flood.

1952 - March 13 Chesley Enterprise, March 20. High water, spring break-up. Sharp freshet.

CHAPTER 3

ENCROACHMENTS

Encroachments include any works of man which are built on the natural flood channel of a river. These flood channels may not be used by the river for several years, but at certain intervals, due to excessive precipitation and other factors, this supplementary channel which it has created for itself will most certainly be flooded, because it must be remembered that flooding is a natural phenomenon of rivers.

In the process of settling a new country, encroachments are often unavoidable because, as is well known, many of our towns and cities were established by the erection of a mill on the river or at the junction of a small stream with a larger one. Gradually as time went on, other businesses followed, shopping districts were built up and spread out around this nucleus of settlement. Thus it happens that such towns, or the older part of them at least, are completely within the flood channel, and when high water occurs, they, of course, are flooded.

The presence of encroachments such as narrow bridges with abutments projecting out into the river valley, factories, buildings and so forth, not only aggravates the flood situation from the standpoint of preventing the free passage of water but also by piling up large cakes of ice which naturally float on the crest of the stream in the spring, accumulating behind these structures and building up a dangerous dam only to break when the pressure becomes too great or the temperature modifies. These encroachments together with the gradual denudation of the forest, especially at the headwaters of the rivers, have aggravated the flood situation on most of our streams in Southern Ontario, and it is largely due to these causes that some major works must be undertaken, chiefly in the building of dams or dikes, in order to protect the towns and cities which occupy the river channel in whole or in part at certain points on its course.

Therefore, one of the chief concerns of an Authority in planning a long-term program for the river valley should be to control and check further encroachments on the river, especially where they are costly permanent structures and will involve the loss of property, goods and human life.

CHAPTER 4

UNDERGROUND WATER

* No consideration of river valley development, or of conservation, or of re-development of agricultural areas, would be adequate or in any way complete without some mention of that water which occurs beneath the surface of the earth, and particularly of that part of the subsurface water that is within the zone of saturation, the ground water. For it is this water that is primarily responsible for the continued flow of surface streams and that supplies, to a very great extent, our domestic and industrial needs.

The water of the earth may be divided into three:

(a) Water in the atmosphere
(b) Water on the surface of the earth
(c) Water below the surface of the earth

The water below the surface may in turn be divided into three:

(1) That above the zone of saturation
(2) That in the zone of saturation
(3) That in the interior of the earth

The water in the atmosphere is perhaps primarily the concern of the meteorologist; that on the surface, of the hydraulic engineer; but that below the surface is directly the concern of the geologist, the agriculturalist, and the engineer.

There is, in general, an upper limit within the earth's crust below which the permeable rocks are saturated; this upper limit is called the water table and it forms the surface of the zone of saturation. The water within this zone is the ground water.

Practically all the water recovered from the zone of saturation, that is, ground water, is derived from the

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* Caley, J. F. Underground Water Supplies. Department of Planning and Development Report, 1945.

atmosphere. Most of it reaches the earth in the form of precipitation, either as rain or snow. Of the precipitation falling on the ground, part is immediately carried away by streams as surface run-off, part evaporates, either directly from the surface and from the upper mantle of soil, or by transpiration of plants, and the remainder sinks into the ground ultimately to be added to the ground-water supplies.

The proportion of the total precipitation that sinks into the ground will depend largely upon the type of soil or surface rock and the topography of the area upon which the moisture falls; if the surface deposits are of sand or gravel more water will sink in than if those deposits were of clay; if the region is hilly and dissected by numerous valleys more water will immediately drain away than if the surface is fairly flat and but little dissected. Steady precipitation over considerable periods will furnish more water to the ground-water supply than will torrential rains; in this case the run-off may be nearly equal to the total precipitation. Moisture falling after the ground surface is frozen will not usually find its way below the surface and therefore will not materially replenish the ground-water supply. Light rains falling during the growing season may be wholly absorbed by plants. The quantity of moisture lost by direct evaporation depends largely upon temperature, wind and humidity.

It is evident, then, that the percentage of the total precipitation disposed of by run-off, evaporation, or percolation below the surface is difficult to determine and depends to some extent upon local factors.

That part of the precipitation that sinks into the ground finds its way downward until it reaches the ground-water level or until it comes into contact with a layer of rock which is impervious to its passage; such a layer may hold water some distance above the general ground-water level. This

is known as perched water. If the ground-water level is at or near the surface there will be a lake or swamp; if it is cut by a valley, there will be a stream.

The conditions under which ground water occurs and the factors determining its quantity, quality, and possible recovery are many. This water is directly associated with the rock into which it percolates and as this rock may (and in south-western Ontario does) vary in its physical properties from place to place, so will the conditions affecting the ground water change.

Because of the large quantities of water that are daily consumed from underground sources, it may be thought that precipitation cannot furnish the entire supply. However, when it is remembered that a layer of water one inch deep over an area of one square mile amounts to about 14,520,000 imperial gallons and that in south-western Ontario the annual precipitation is perhaps in the order of 30 inches, it will be seen that over 420,000,000 gallons fall on each square mile each year. If we estimate that only 10 to 20 per cent (surely a conservative estimate) of the annual precipitation reaches the zone of saturation, there is still an appreciable quantity of water available to recharge the ground-water supplies.

It is not implied that the ground-water supplies are inexhaustible. So long as the annual recharge, that is the quantity of water reaching the zone of saturation, is equal to or greater than the quantity withdrawn, the ground-water supplies will not materially decline. Unfortunately, however, there are parts of south-western Ontario where this condition does not prevail. It is common knowledge that once permanent streams are now dry, that many springs have disappeared and many wells have failed. Such a condition is in large measure the result of cutting down of forest trees, draining of swamps, and bringing into cultivation areas that

perhaps should have been left as woodlots. In general, the same quantity moisture is falling now as before the streams ceased flowing, but so far as ground water is concerned one of the most important results of the aforementioned conditions is the great increase in surface run-off, culminating all too often in disastrous floods and reducing greatly the quantity of water that formerly went to recharge the subsurface supplies. Couple with this the increase in population with its ever increasing demand upon ground water for both domestic and industrial needs, and it is not difficult to see that the ground-water resources will still further decline unless some remedial measures are taken.

Getting back to the geology of ground water; all sedimentary rocks are to some degree porous, that is, they possess pores between the individual grains of which they are composed. Water stored within the rocks mainly occurs as filling these spaces. A very fine-grained rock containing water may have such small pores that the attraction between the rock and water is great enough to hold the water in the rock; such a rock will not yield its water to wells. Those rocks that yield their water readily are called aquifers; those that do not are impervious beds.

For the present purpose the geology of south-western Ontario may be divided into two parts; the bedrock and the overlying unconsolidated glacial deposits.

The bedrock consists of layers of limestone, shale and sandstone that, when viewed at an isolated outcrop, generally appear to be flat-lying, but that regionally are known to dip from 10 to perhaps 40 or 50 feet a mile in a general south-westerly direction. These rocks are sedimentary in origin, having been formed from sediments deposited in bodies of sea water later to be consolidated into hard rock.

The water-bearing properties of the various types of rock constituting this sedimentary succession vary greatly.

In general, the shales, being fine-grained, are the poorest aquifers, while the sandstones and limestones are considerably better.

No special study of the water in these rocks has been made, but they have been mapped over much of south-western Ontario so that the distribution, thickness, and general physical characters of the several formations are fairly well known. In the area bordering Lake Erie, the bedrock has been penetrated to various depths by wells drilled for oil and gas, and a study of these drilling records has yielded some general data regarding water. Thus it is that we know of occurrences of fresh water generally in the upper part of the bedrock; of sulphur water somewhat lower; and of salt water at still lower depths.

Overlying the bedrock is the glacial drift. During the final stages of geological history great accumulations of ice formed at several centres in Northern Canada. Due to the pressure exerted by the immense thickness of ice, the ice moved out in all directions from these centres, covering large areas with a continental ice sheet. As the ice advanced it picked up great quantities of loose rock which it carried along and which was deposited when the ice finally retreated by melting. This material is unconsolidated and called glacial drift. Several advances and retreats of the ice sheet took place and each retreat left its accumulation of drift on the surface over which it passed.

Thus, over most of south-western Ontario the bedrock is covered with drift ranging in thickness from zero in parts of the Bruce Peninsula to over 600 feet in the region north of Toronto.

Generally, the drift consists of boulders and pebbles of various composition and size embedded in a matrix of clay to form a more or less impervious mass called boulder clay. Intermingled with this, and commonly in a most complex

manner, and also lying above, below, and between successive tillsheets are beds, lenses and pockets of waterlaid sand and gravel which form the chief water-bearing members of the drift.

Throughout the greater part of South-western Ontario most of the ground-water supplies are directly associated with the glacial drift.

CHAPTER 5

GENERAL HYDRAULIC PROBLEMS

Hydraulics as applied to conservation deals with the measurement and control of run-off from river drainage basins. Measurement has to do with such factors as precipitation - both rain and snow - the topography and vegetative covering of the area and the daily gauging of the flow of the river at selected points. Control deals with the prevention of floods by the use of reservoirs and other structures, and the increase of summer flow.

Floods which are caused by the natural run-off from river basins have occurred from time to time in Southern Ontario ever since records were first kept. Evidence of these can be found in diaries going back well over 150 years and from newspaper records for at least 100 years. Most of this run-off occurs in the spring, with the result that there is too much water in our rivers at the time of the year when it is needed least and very little, if any, during midsummer when it is required most. In addition to the flooding which is caused by spring run-off, occasional floods also occur during the summer on watersheds which have little natural protection. These summer floods do serious damage to crops. Such floods are not confined to a few of our largest rivers, but records show that all rivers of any consequence have from time to time caused serious damage in this way.

When Ontario was mostly covered with forest and the natural reservoirs, such as large swamps, had not been interfered with, severe flooding probably was not as frequent as it is today because these two factors had an ameliorating effect on the flow of water. Land clearing and drainage were necessary to open up the country for agriculture, but in some respects these were carried beyond the point of necessity, thereby aggravating the flood situation. In order now to regain

a more or less stable condition of the rivers and streams, certain conservation measures must be carried out, such as the reclaiming of large swamps and water storage areas, the reforestation of marginal and submarginal land, and also by a program of proper land use as indicated by farm planning, whereby run-off from gently sloping land can be controlled by such methods as contour cultivation and grass land where such is indicated. Such methods aim to control water where it falls on the land. If this could always be done it would be the ideal solution of the flood problem. But to minimize the required flood storage in a large watershed, a program of improved land use would need the co-operation of a great many individual farmers. This would take many years to accomplish. More immediate measures are therefore also necessary, especially where urban centres are frequently flooded.

One of the first problems facing the hydraulic engineer is to estimate or measure the run-off from a drainage basin which causes flooding farther down the valley. This includes a careful examination of rainfall over the years at different times of the year, which in turn presupposes that weather stations have been established in the area. Topography, types of soil, the amount of vegetative covering, particularly tree growth, on the area, and the gradient of the river, which has a bearing on the rapidity with which the water travels to the river's mouth, must all be carefully studied. If no gauging stations have been established then the run-off must be computed by taking the above factors into consideration and an approximate figure of flow is then determined by comparison with a neighbouring drainage basin which has gauge records in order to decide how much protection by the use of reservoirs is required. If, on the other hand, gauges have been established, by which a daily record is kept of the amount of water going down the channel at certain points, then a more accurate determination can be made of how much protection is needed. Fortunately,

at Walkerton and Port Elgin on the Main Saugeen, there are hydrometric records dating from 1914.

After the amount of run-off has been measured by whichever means are available to the engineer, it will give him a figure of flow which will indicate how much of this water will have to be held back by different methods in order to give the necessary protection where flooding is taking place. This means that a reconnaissance survey of the whole watershed must be made in order that suitable valleys be selected where dams can be built for the storing of the required amount of water. When more than a sufficient number of such reservoir sites have been selected, each must be measured as to its capacity, and the required number chosen to hold back sufficient water to solve the flood problem. In addition, wherever a dam is to be built, some subsurface exploratory work must be done at the site to make certain that the dam will have a proper foundation. Only after this preliminary work has been carried out can the reservoirs be finally chosen, the actual designing of the dam structures undertaken and the work carried through to completion.

While conservation reservoirs are usually built for the purpose of preventing floods, they are needed just as much in Southern Ontario for increasing summer flow. This has become increasingly important in recent years because rivers with extreme low flow and those which dry up entirely are a health menace to the communities through which they pass. Summer flow is necessary for flushing out the channel; to furnish water for industrial plants; for the practice of good agriculture; and is absolutely necessary for dilution where urban municipalities empty the effluent of their sewage disposal plants or raw sewage into the river.

The building of dams for the prevention of flooding and the increasing of summer flow is a comparatively new concept in engineering. It is only since the turn of the century that structures of this kind have been used for this

purpose in North America. The older methods included such projects as straightening and widening the river, narrow bridges and other man-made works which might obstruct the flow or cause ice jams. Also, occasionally, for such work a river was diverted into another watershed, or dikes were built to hold it within its banks. Such practices are aimed at one thing only, namely to get rid of water as quickly as possible. They do not take into consideration the necessity of holding water at the headwaters for deep infiltration or retaining it for summer flow throughout the year. On some rivers in Ontario channel improvements, diversions and even dikes must be carried out and built, especially where dams and reservoirs are not economical and summer flow is not a major problem.

CHAPTER 6

HYDRAULICS AND CONTROL MEASURES

1. Measurement of Run-Off

Run-off is measured by installing gauges (rods graduated in feet and hundredths of a foot) in the river at strategic points. They are rated and the rate of flow in the river at the gauge is known in cubic feet per second (c.f.s.) for any reading or elevation of the gauge. The gauges may be of two types: either automatic, which show a continuous record of flow on graph paper, or staff gauges, which are read manually twice daily, and oftener during flood periods or heavy storms.

The Dominion Government installs and administers the gauges and publishes their records. The records show the mean daily or average flow for each day, the mean monthly or average flow for the month, and the maximum and minimum mean daily flows for each month. During flood periods staff gauges are usually not only read at frequent intervals but the peak flow or highest stage is also recorded.

There are two staff gauges installed on the Main Saugeen, dating from 1914: "Walkerton", located on a traffic bridge four miles up stream, and the other, called "Port Elgin", located on a traffic bridge 3½ miles north-east of Port Elgin and six miles up stream from Southampton. Gauges were also installed at Markdale and Traverston on the Rocky Saugeen and on the Teeswater above Paisley, but were discontinued after a few years of operation.

2. Hydrographs

> "The Hydrograph is a correct expression of the detailed run-off of a stream, resulting from all the varying physical conditions which have occurred on the drainage area above the gauging station previous to the time which it represents.*

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* Definition given in "Hydrology" by Professor D. W. Mead.

Continuous hydrographs are shown for the years of records for the Walkerton and Port Elgin gauges in Figs. H-2 and H-3 respectively. Superimposed hydrographs for the four greatest floods at Walkerton are shown in Fig. H-4 and the the same for the Port Elgin gauge in Fig. H-5. Fig. H-4 also shows the hydrograph for a hypothetical flood at Walkerton one and one-third times greater than the greatest on record, viz. the spring flood of 1947. (The 1948 spring flood had a slightly higher maximum mean daily flow, but was of a shorter duration and approximately 10 per cent less in total volume) The vertical measurements represent the flow in c.f.s., the horizontal measurements the time, and the area below the hydrograph the volume of flow for any given time. It is by means of the hydrograph that the volume of storage in reservoirs is determined, it being approximately the area above a "channel capacity" flow line, or the rate of flow at the stage when the river overflows its banks. These channel capacity tests have not been made yet.

3. Control Measures

Most of the rivers in Southern Ontario have a low summer flow problem as well as a flood problem. In order to satisfy the former problem, it is necessary to build dams and impound part of the spring run-off in reservoirs, which is subsequently released to increase the low flows. Although a monthly mean flow as low as 50 c.f.s. was recorded at the Walkerton gauge for September 1914, the average monthly mean for 37 years of records for September, the month of lowest flow, was 186 c.f.s., and for the other summer months, June 374 c.f.s. July 262 c.f.s. and August 203 c.f.s.

With the exception of Durham and possibly Chepstow, there are reservoir sites that would provide flood protection for the other trouble areas, but for the above reason it is believed that reservoirs for flood control would not be justified at the present time and instead, if feasible, the less expensive expedients of channel improvement and dikes should be carried out.

HYDROGRAPHS

GAUGE at WALKERTON

Drainage area 831·48 sq. miles

Mean daily flows plotted from records of the Water Resources Division, Department of Resources & Development, OTTAWA

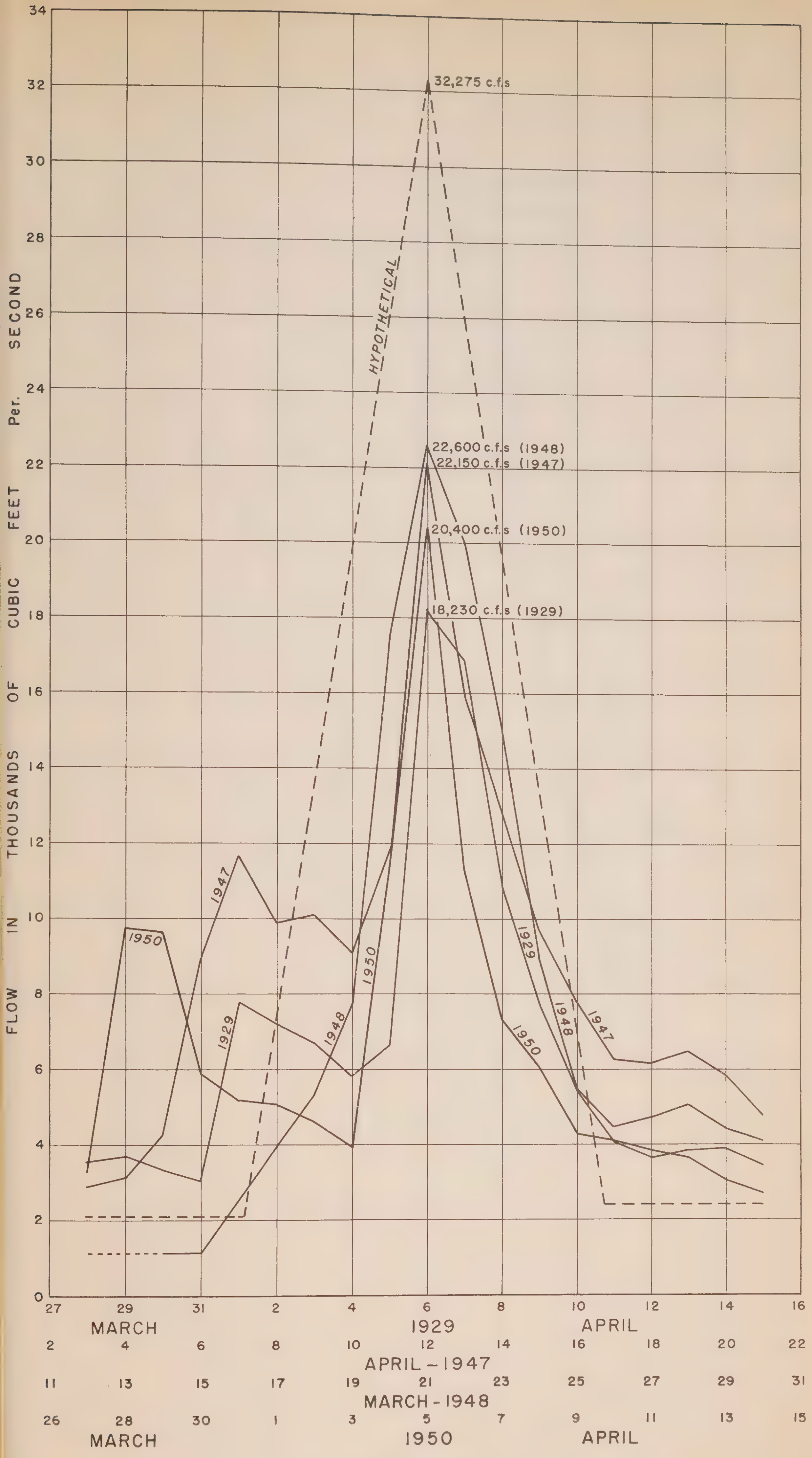
FIG. H-2

HYDROGRAPHS

Gauge near PORT ELGIN — Drainage area 1528·8 sq. miles

Mean daily flows plotted from records of the Water Resources Division,
Department of Resources & Development, OTTAWA

FIG. H-3

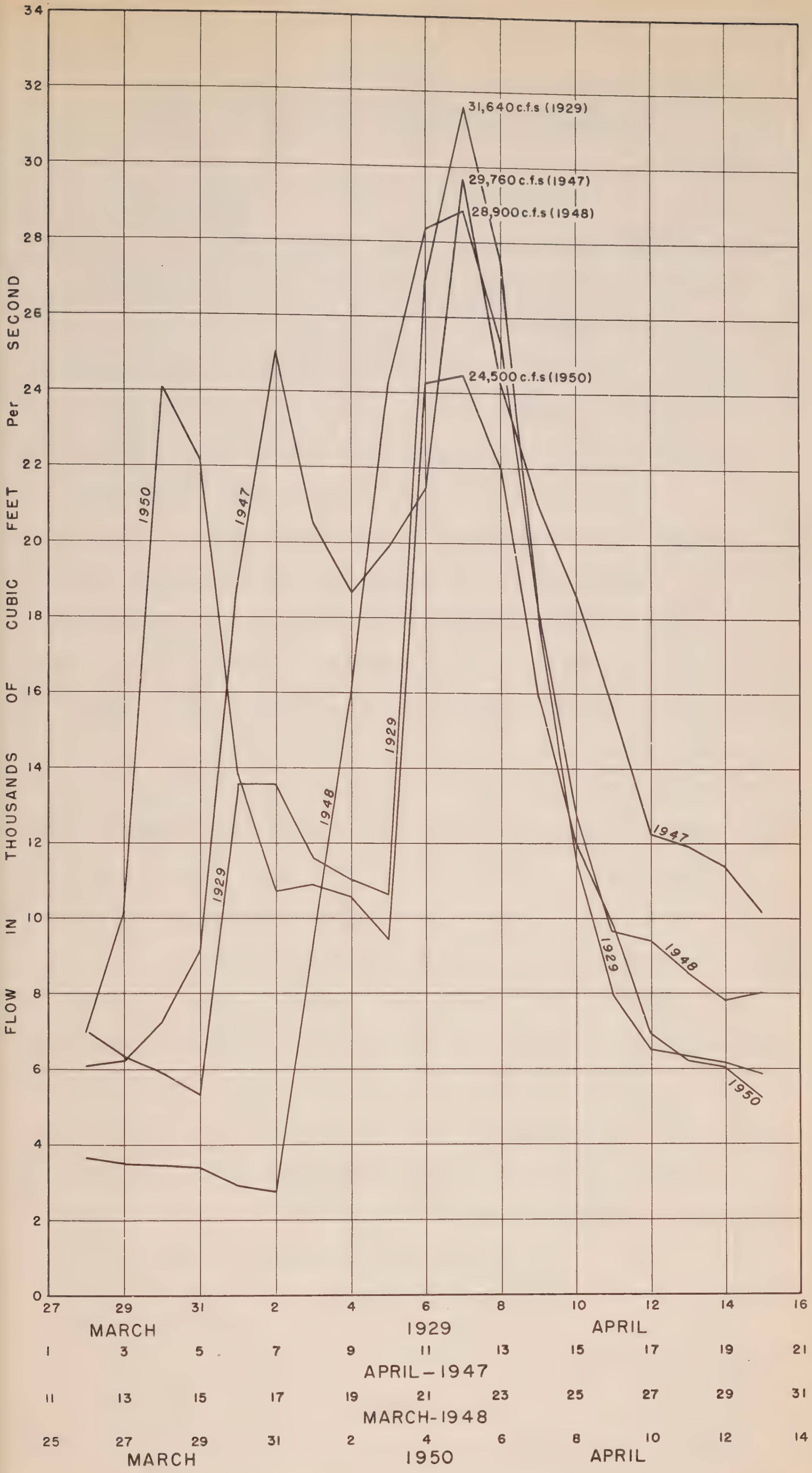


HYDROGRAPHS

Gauge at WALKERTON – Drainage area 831·5 sq. miles

Mean daily flows from records of the Water Resources Division
Department of Resources & Development, Ottawa.

FIG. H-4



HYDROGRAPHS

Gauge near PORT ELGIN – Drainage area 1528·8 sq. miles

Mean daily flows from records of the Water Resources Division

Department of Resources & Development, Ottawa.

FIG. H – 5

CHAPTER 7

FLOOD CONTROL FOR THE TOWN OF WALKERTON *

1. Introduction

The Saugeen River system above Walkerton has its headwaters in the highlands which extend south from Georgian Bay, and tributary to the Main Saugeen are the South Saugeen, Beatty Saugeen and the Rocky Saugeen. The general course of the river is westerly from Durham, through Hanover to Walkerton and thence north-westerly through Paisley to Southampton on Lake Huron.

The watershed of the Saugeen River above Walkerton has an area of approximately 900 square miles. It is contiguous to the watersheds of the Maitland River and the Grand River and their tributaries to the south, and the Mad, the Beaver, the Bighead and the Sydenham Rivers to the north.

The drainage basin of the Saugeen River is mostly comprised of rolling farm lands except at the upper reaches where the watershed is rugged, and well forested. The river valley consists of river flats or flood plains bordered by high clay cliffs.

The valley bottom acts as a natural flood plain in times of spring freshet; and towns, such as Walkerton and many others in Ontario, which in the early days were founded on these lands, constitute an encroachment on the natural flood channel and are consequently subject to flooding. This situation has been aggravated by the increase in size and frequency of river flooding due to the development of drainage systems and the clearing of the land.

2. River Gradient

Between the headwaters of the Main Branch of the river and the river channel at Walkerton, there is a difference in elevation of 900 feet in a distance of 64 miles.

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* From a report prepared by the Kilborn Engineering Company Limited of Toronto.

This is equivalent to an average gradient of 14 feet per mile. The elevation differential from Durham to Walkerton is 300 feet or approximately 11 feet per mile. Between Walkerton and a point 4 miles down stream the differential is only 20 feet or a gradient of 5 feet per mile; and a point 12 miles down stream is 70 feet lower than Walkerton, which is equivalent to an average grade of 6 feet per mile.

The flattening out of the river gradient below Walkerton contributes greatly to the conditions which cause flooding.

3. Flood Flows

The flood flow for the year 1947 has been slightly exceeded once only during the period in which records were kept - 1920-1951. This maximum flood flow is, therefore, used herein as the design flow.

In order to determine the peak flow which was experienced at Walkerton during the spring of 1947, high water elevations above and below the dam were obtained from recorded marks on buildings or other structures and from ice scars on trees. Using these points, the surface curve was drawn and the elevations of the peak water level directly above and below the dam were determined. As the dam acts as a submerged weir during large floods, we have used these elevations to calculate the 1947 peak flow, which we compute to be 25,000 cubic feet per second.

From the records of the Water Resources Division, Department of Resources and Development, Ottawa, the river gaugings four miles up stream from Walkerton were obtained. By use of Fuller's equations the maximum mean daily flow at Walkerton was computed and converted to a peak flow. By this method the peak flow was calculated to be approximately 29,000 cubic feet per second, which is considerably in excess of the more accurate method of calculation previously described.

The peak flow obtained by drawing a curve through the mean daily flows is approximately 25,000 cubic feet per second.

Our recommendations are based on handling a flow equal to the 1947 peak which we accept as 25,000 c.f.s.

4. The Problem

The problem is to determine the most feasible method of controlling the flood flows of the Saugeen River at Walkerton so that property losses due to flooding may be prevented.

5. Solution of the Problem

Excessive river flooding may usually be ameliorated or prevented entirely by one or a combination of several of the following methods:

(a) Storage reservoirs for the purpose of impounding water during the periods of high run-off and later release during the dry season.

(b) River channel improvement, including enlarging the channel, removing obstructions and restrictions and improving the grade, so that the peak flows may be contained within the normal banks of the river.

(c) Dikes constructed along the banks of the river so that the peak flows expected may be prevented from inundating surrounding lands.

(d) Diversion canal, excavated to an adequate size to by-pass the excess water around the area to be protected.

6. Storage Reservoirs

There are a number of potential reservoirs above Walkerton but as yet none of these has been surveyed to determine accurately the water which could be impounded or the cost of dams and appurtenant items. Since it is beyond the scope of this report to investigate such dam and reservoir sites this matter was not studied further.

There is no doubt that prevention of flooding by the use of flood control reservoirs is superior to other methods because (a) the benefits extend to other flood-menaced communities lower on the river and (b) the waters so impounded may be used to great advantage in increasing river flows during the drier times of the season. As the other more immediate schemes are designed to handle the greatest flood on record only, a long-term plan should include investigation of reservoirs.

7. River Channel Improvement

As the gradient of the Saugeen River during flood periods below the Yonge Street bridge at Walkerton is very flat, the water can be lowered only slightly by improving the river channel. Any improvement above the bridge would be of little avail as the flood waters would still be too high to eliminate the necessity of storage reservoirs or diking.

However, a large percentage of the flood flow passes over the river flats or flood plains along its course, so when these flats are cut off by diking, some river channel improvement must be instituted to accommodate this water. Therefore, at Walkerton widening and deepening of the channel must be carried out from a point above the C.P.R. bridge to below the Yonge Street bridge, if diking is to be effective.

8. Dikes

A diking scheme to prevent a flood, equal to the 1947 peak, from inundating part of the town of Walkerton is feasible when combined with the channel improvement previously mentioned. Such a scheme would necessitate about 3,500 feet of diking on the north side of the river and 7,100 feet of diking on the south side. Also included would be:

(a) Pipes or sluices to allow Silver Creek to pass through the dike;

(b) rip rap above and below the Yonge Street bridge on the south side;

(c) 3-5-foot diameter pipes or sluices, flap gates and items for the mill flume;

(d) a concrete wall along a portion of the channel abutting the Canada Spool and Bobbin Plant No. 1;

(e) raising the existing dikes in places;

(f) providing pipe and flap gates for surface drainage through the dikes;

(g) flap gates for all existing sewers or drains;

(h) gravel surfacing where the road to the C.P.R. coal sheds would have to be filled;

(i) grass seed sown and sod laid on the berm between the dike and the channel, and on both sides of the dike.

No means of keeping Knechtel's Mill and the Truax water wheels running during the flood was considered feasible. At other times the water will pass through the pipes, automatically opening the flap gates.

The pipe drains passing through the dike will discharge during periods of low flow but will store the surface water behind the dikes during the flood period which should not be of long enough duration to cause serious flooding.

The storm drains may need some special treatment other than flap gates on the end, but such investigations would be covered in a final report. Such items should not materially affect the estimated total cost.

The proposed pipes under Archie Street and under Durham Street will pass the complete flow of Silver Creek at all times. The dikes on either side of the Creek prevent the creek from inundating the surrounding land.

It will be necessary to rip rap the dike (for economic reasons) where it is proposed to be located on the edge of the channel. The channel is sufficiently large at Yonge Street bridge that the dike can occupy a small portion of the flow area. Concrete walls along this section would be very expensive.

The Canada Spool and Bobbin No. 1 plant has several buildings so close to the river channel that the dike would have to be put in the channel or a concrete wall provided. Since the channel is narrow at this point, the concrete wall is the more feasible.

The estimated cost as outlined above including the channel improvement would be $159,360.00, for details of which see section 12.

However, the estimated cost of land to be purchased and the moving or buying of sheds or other buildings would be $10,000, making the estimated total $169,360.00.

9. Diversion Canal

The topographical map of the area was examined with a view to locating a route along which a channel might be constructed to divert or by-pass flood waters around Walkerton. Owing to the high relief of the district, it was evident that the cost of such a channel would be exorbitant, and no further investigation of this method of flood control was made.

10. Conclusions

Property damage due to flooding at Walkerton may be ameliorated by constructing flood control reservoirs on the upper river system, or by diking the banks of the river and improving its channel through Walkerton. However, the study of the watershed above Walkerton, in order to locate and survey effective flood control reservoirs, is not within the scope of this report.

From our investigations we conclude that diking of the river in Walkerton, combined with certain channel improvements, is a feasible method of flood control.

The program of construction recommended by this report is based on channelling through Walkerton a peak flow of 25,000 cubic feet per second, which represents the calculated peak flow of the 1947 flood.

Improvements to the channel, mentioned above, will be necessary from above the C.P.R. bridge to below the Yonge Street bridge.

Dikes would have to be constructed in the following locations:

(a) From the Exhibition Grounds to Yonge Street bridge, a distance of approximately 1,900 feet along the south side of the river.

(b) Around Silver Creek, a distance of approximately 1,700 feet including both banks of the creek.

(c) From Mink Farm to the Yonge Street bridge, a distance of approximately 1,600 feet on the north side of the river.

(d) From Yonge Street bridge to high ground, a distance of approximately 600 feet on the north side of the river.

(e) From the Yonge Street bridge to the C.P.R. bridge, a distance of approximately 2,300 feet on the south side of the river.

(f) From the C.P.R. bridge to Durham Street bridge, a distance of approximately 1,200 feet on the south side of the river.

(g) From high ground to the C.P.R. bridge, a distance of approximately 600 feet on the north side of the river.

(h) From Durham Street bridge to the corner of William and Orange Streets, a distance of approximately 700 feet on the north side of the river.

The following items of construction are necessary in relation to the system of dikes:

(a) Pipes through the dikes with flap gates for surface drainage.

(b) Rip rap along the section on the south side of the river at the Yonge Street bridge.

(c) A concrete retaining wall extending approximately 170 feet down stream from the Durham Street bridge on the north side of the river.

(d) Large pipe or sluices to allow Silver Creek to pass through the dikes, approximately 200 feet of 8-foot diameter pipe.

(e) Pipes and flap gates for the mill flume - 3-5-foot diameter pipes or sluices to pass through the dike.

(f) Sodding and seeding to grass all dikes.

(g) Filling and gravelling the road to the C.P.R. coal sheds.

(h) Boarding of mill flume head gate to high water level as it is necessary to close this gate during peak flows.

(i) Raising existing dikes.

(j) Providing existing sewers with flap gates.

The program would require the purchase of some land and the purchase or cost of moving certain sheds and other buildings.

The estimated cost of diking including appurtenant works, channel improvement, purchase of land and moving buildings and other necessary items is $169,360.00.

The implementation of the recommended works will not, in our opinion, have any effect upon the flood damage either above or below the town of Walkerton.

11. Recommendations

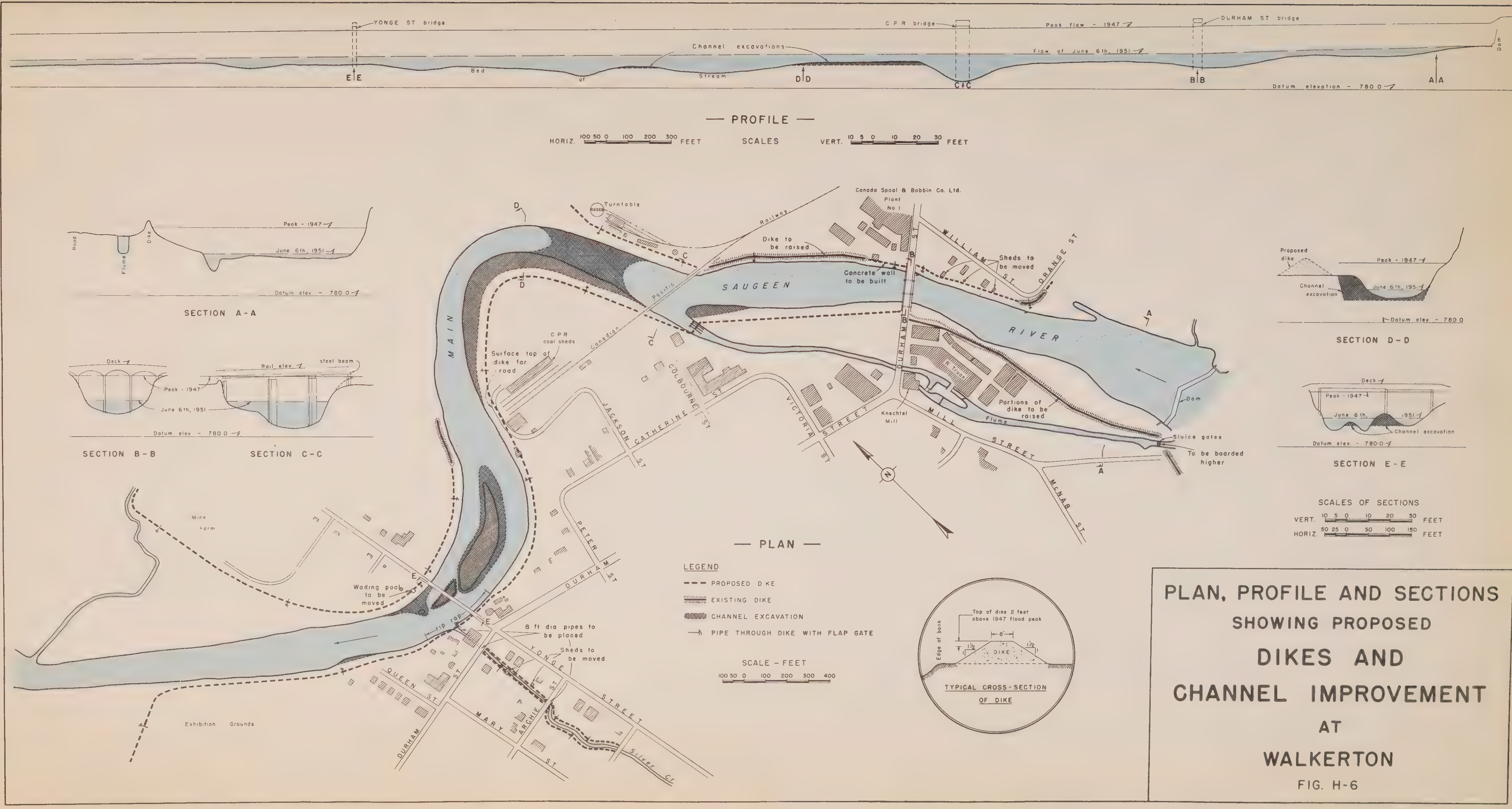
Based on the results of our investigations into feasible immediate flood control measures for the protection of the town of Walkerton, we recommend that:

(a) Dikes and appurtenant works be constructed as described under section 5 (Solution of the Problem) and indicated on Fig. H-6.

(b) The river channel be improved as described under section 7 (River Channel Improvement) and indicated on the same Figure.

12. Estimate of the Cost of Diking and Channel Improvement, Saugeen River at Walkerton

(1)	River Channel Excavation		$35,290.00
(2)	Diking:		
	(a) Dike material, dumped, spread and consolidated...	$25,535.00	
	(b) Rip rap..................	6,000.00	
	(c) Sodding and seeding to grass	11,500.00	
			43,035.00
(3)	Additional Construction:		
	(a) Concrete retaining wall	26,375.00	
	(b) Surface drainage discharge pipes through dikes	4,750.00	
	(c) Pipe required in Silver Creek, installed	11,900.00	
	(d) Mill flume tailworks ..	8,540.00	
	(e) Raising road to C.P.R. coal sheds	800.00	
	(f) Sewer discharge pipe and gates	2,400.00	
			54,765.00
(4)	Field supervision		3,600.00
			$136,690.00
(5)	Contingencies - 10%		13,670.00
			$150,360.00
(6)	Engineering: detailed survey, plans, specifications, tender call and normal supervision - 6%		9,000.00
	ESTIMATED COST OF ABOVE		$159,360.00
(7)	Cost of land, moving buildings, compensation, legal surveys and legal fees		10,000.00
	TOTAL ESTIMATED COST		$169,360.00



PLAN, PROFILE AND SECTIONS SHOWING PROPOSED DIKES AND CHANNEL IMPROVEMENT AT WALKERTON

FIG. H-6

WILDLIFE

CHAPTER 1

INTRODUCTION

Land well adapted for fish and wildlife should produce or harbour a permanent population of interesting and useful species and an annual crop of fish, game and fur. These populations should be adapted in agricultural land so they they have no adverse effect on all reasonable farming practices. The control of harmful species and the maintenance of all other animal populations at a desirable level, through the provision of a proper "habitat" or living quarters, is a natural branch of good land management.

The maintenance of the proper balance between the numbers of the various species can be achieved in many ways. Many species if left undisturbed will help to control others which are not wanted. The hawk which preys on destructive meadow mice in an orchard is worth many dollars to the farmer who protects it. This type of management has been much neglected in Canada. The traditional methods of game and fish management have included restrictions of the daily and seasonal kill and of the method of kill, predator control, reservations of game lands and artificial restocking. The provision of a proper habitat is often more important than all of these.

Wildlife planning thus requires a study of the existing habitat and a study of the wildlife populations, particularly the dynamics or changes of populations over a period of several seasons. The second requirement cannot be carried out in a rapid survey. Moreover a beginning has only recently been made in the basic research on game environments in Southern Ontario. The techniques of stream surveys are farther advanced. The Saugeen River has long been one of the more important fishing streams of Southern Ontario. The field work was therefore concentrated chiefly on the condition of the river and its suitability for fish.

CHAPTER 2

PRESENT SPECIES

1. Game

No detailed study of the populations of any of the game species was made during the survey. There is little territory suitable for breeding wild ducks in the watershed. Common snipe are also scarce. Much of the lower lands appeared to provide suitable ground for woodcock, although few were met with during the summer. The watershed was examined and mapped as suitable or unsuitable territory respectively for deer, ruffed grouse and the European hare, the three chief game species occurring. Apart from the flat and poorly drained sector in and around Osprey Township, the watershed as a whole is remarkably homogeneous, providing very diverse conditions in every township examined. The map of game habitats is available for reference.

2. Birds

The part of the Saugeen Watershed examined lies close to one of the main migration flyways of North America. It includes most types of habitat for birds, although large lakes and extensive beaches are absent and wide mudflats are rare. There are probably 250-275 different kinds of birds which either live in or migrate through the watershed every year. A list of these species would be largely hypothetical, since most of the early migrants and winter visitors were not seen during the 1951 survey, but 141 species were observed by two members of the party during the summer. Twenty-five of these species were migrants. The remainder, including almost all the birds which may be expected to be found in the watershed in summer, number 116 and are listed below. The arrangement and the names are from L.L. Snyder's "Ontario Birds", 1951.

Common Loon
Pied-billed Grebe
Great Blue Heron
Green Heron
American Bittern
Mallard
Black Duck
Green-winged Teal
Blue-winged Teal
Wood Duck
Hooded Merganser
Common Merganser
Turkey Vulture
Sharp-shinned Hawk

Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Bald Eagle
Marsh Hawk
Osprey
Sparrow Hawk
Ruffed Grouse
Common Pheasant
Virginia Rail
Killdeer
American Woodcock
Common Snipe
Upland Plover
Spotted Sandpiper
Herring Gull
Ring-billed Gull
Bonaparte's Gull
Rock Dove
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Screech Owl
Horned Owl
Long-eared Owl
Saw-whet Owl
Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Yellow-shafted Flicker
Pileated Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Crested Flycatcher
Eastern Phoebe
Yellow-bellied Flycatcher
Traill's Flycatcher
Least Flycatcher
Eastern Wood Pewee
Olive-sided Flycatcher
Horned Lark
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin

Blue Jay
Crow
Black-capped Chickadee
White-breasted Nuthatch
Red-breasted Nuthatch
House Wren
Winter Wren
Sedge Wren
Catbird
Brown Thrasher
Robin
Wood Thrush
Veery
Bluebird
Cedar Waxwing
Great Shrike
Starling
Red-eyed Vireo
Warbling Vireo
Black and White Warbler
Yellow Warbler
Black-throated Green Warbler
Chestnut-sided Warbler
Oven-bird
Water-thrush
Mourning Warbler
Maryland Yellow-throat
Canada Warbler
American Redstart
House Sparrow
Bobolink
Eastern Meadowlark
Red-wing
Baltimore Oriole
Grackle
Cowbird
Scarlet Tanager
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Purple Finch
American Goldfinch
Towhee
Savannah Sparrow
Grasshopper Sparrow
Vesper Sparrow
Chipping Sparrow
Field Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow

CHAPTER 3

IMPROVING THE FARM FOR WILDLIFE

The present survey did not include detailed work on farm or forest wildlife. There are many varied types of land in the watershed. The requirements of food and cover vary greatly for the different species of wildlife. The recommendations here listed are therefore those which can be most generally applied by the landowner.

1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Large-scale reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive

area is denuded of cover at one time by harvesting. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common on the Saugeen Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. Rosa multiflora is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness it should not be planted on the Saugeen Watershed without consultation with the nearest biologist or forester of the Department of Lands and Forests.

3. Cover Patches

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

4. Ponds and Streams

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish. Willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas will soon be invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current, and fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced.

Sago Pondweed	Potamogeton pectinatus L.
Red-Head Pondweed	Potamogeton Richardsonii (Ar. Benn.) Rybd.
Wild Millet	Echinochloa crusgalli (L) Beauv.
Japanese Millet	Echinochloa frumentacea (Roxb) Link
Wild Celery	Vallisneria americana Michx.
Knotweed	Polygonum pensylvanicum L.
Water-Smartweed	Polygonum coccineum Muhl.
Three-square	Scirpus americanus Pers.
Great Bulrush	Scirpus validus Vahl., var. creber Fern.

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in the chapter on Farm Ponds of this report. Farm ponds differ from those intended

for wildlife in that care is usually taken to prevent the growth of aquatic vegetation in a farm pond intended only for watering stock or fire protection purposes. Otherwise the construction and details of ponds for wildlife should follow one of the types there described.

CHAPTER 4

FISH

The purpose of this survey was to make a preliminary examination of the waters of the drainage basin and to classify them as to their present suitability for fish, and secondly, to make recommendations for possible improvements.

1. Methods

The river and its tributaries were visited at 225 "stations", most of them at road crossings. The stations were from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The collections were later examined and classified, and were used in zoning the various sections of the river, as shown on the accompanying map. The aquatic insects such as mayflies, stoneflies and caddisflies were most useful for this purpose, since many of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted water or of the maximum summer temperature of the water. Thus the potentialities of a stream for particular species of fish are indicated. The fish collections substantiated these findings at their particular stations.

The procedure here adopted follows that used in previous river surveys by the Department of Planning and Development and allows close comparisons of the characteristics of many rivers. The present criteria and methods evolved from more intensive year-round research carried out on parts of the Nottawasaga River and Algonquin Park streams, already reported

on*, †, **and from other unpublished research data made available for this work.

The great majority of the stations could be examined only once during the summer. It was therefore necessary to rely on deductions made from the presence or absence of species which extensive previous tests have shown to be reliable indicators.

Maximum and minimum recording thermometers were installed in the water at eight stations, from June 15 to September 3, 1951. Temperatures were recorded and the thermometers reset every two days.

2. The River Valley

The conditions which determine the kinds of fish inhabiting a river system are in part a product of the physiographic conditions of the watersheds. These are described in detail in the chapter on Physiography of this report. Only the major features determining the river's course and condition are mentioned here.

The area examined in 1951 constitutes the central section of the headwaters of the Saugeen River. The Main Saugeen rises in the silty plain north of Dundalk. Drainage is poor and this part of the river is sluggish, with several small and much-ditched tributaries. Apart from this section the streams flow chiefly through sandy and gravelly deposits overlying the limestone bedrock. Only the larger streams have cut through to the bedrock itself.

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* Ide, F. P. The Effect of Temperature on the Distribution of the Mayfly Fauna of a Stream. University of Toronto Studies, Biology 39, Publication Ontario Fisheries Research Laboratory 50. 1935.

† Ide, F. P. Distribution of Aquatic Insects in the Lower Reaches of the Credit River. 1934 (unpublished).

** Ide, F. P. Quantitative Determination of the Insect Fauna of Rapid Water. University of Toronto Studies, Biology 47, Publication Ontario Fisheries Research Laboratory 59. 1940.

Most of the streams follow the lines of former glacial meltwater channels or spillways and cut indiscriminately across the earlier glacial landforms. A few of the streams start their courses from residual lakes, but most begin in swamplands, which are spring-fed in many places. The streams wending their way from swamplands are remarkably clear, with occasional falls and rapids. The upper part of the Main Saugeen and the lower part of the Styx River are the chief sections which exhibit meanders and the beginnings of oxbows.

The gravelly hills (in the east and south of Glenelg Township and in Egremont and the south part of Bentinck Township) have few good springs in the hillsides. The waters percolate down to the swampy flats which surround these hills and there flow out as sluggish streams. More springs are found in the whaleback hills in central Bentinck Township.

Small residual lakes are common in the part of the watershed examined. Most of them were larger in earlier post-glacial times and are still gradually decreasing in size. Many of the larger ones are located in the floors of glacial spillways, and these, as a rule, have surface outlets, but most of the smaller ones are found in hollows within the moraines and lack surface outlets.

3. Permanence of Flow

The permanence of flow of the various branches and tributaries is shown on the accompanying map "Biological Conditions of Streams". Very few of the watercourses dry up completely in summer.

The flow gauge nearest to the area examined is at Walkerton, and the flow there, measured daily, includes the South Saugeen, Beatty Saugeen and some smaller tributaries, in addition to the flow from the area examined. A comparison of the minimum daily flows for the years 1914-1951 follows.

	1951 Minimum Daily Flow c.f.s.	1914-1951 Average of Minimum Daily Flows Recorded c.f.s.	1914-51 Minimum Daily Flow Recorded c.f.s.
August	193	204	81 (1917)
September	208	185	50 (1914)

The minimum flow in August 1951 was thus a little less than the average minimum and in September a little more than the average minimum. The flow of the Saugeen tends to be less in September than in August. These are the lowest months. The least daily flow recorded since 1914 was 50 cubic feet per second. In summers with high flow much of the additional flow may be surface run-off, warmer than the more permanent flow from springs. Hence it cannot be assumed that the streams would necessarily be warmer if the summer flow were reduced.

The following table relates the summer flows of the Main Saugeen and Rocky Saugeen to the areas of their drainage basins.

River	Flow (c.f.s) Estimated August 1951	Drainage Area Sq.Mi.	C.f.s. per Sq. Mi.
Rocky Saugeen	55	110	.50
Main Saugeen (above junction with Rocky Saugeen)	25	140	.18
Main Saugeen above Hanover	150	396	.38

It is apparent that the Rocky Saugeen has a much greater summer flow per square mile of drainage basin.

The relative flows* of the chief branches and tributaries follow.

Stream	Flow (Cubic feet per second)
Main Saugeen	
At Priceville	10

* Estimated in August 1951.

Stream	Flow (Cubic feet per second)
At Durham	25
At Allan Park	80 (includes Rocky Saugeen)
At Hanover	150
Rocky Saugeen	
At Markdale	25
At Traverston	45
At Aberdeen	55
Tributaries	
Traverston Creek	8
Bunessan Creek	9
Camp Creek	25
Habermehl Creek	3
Styx River	16
Black's Creek	12

Camp Creek appears to provide a remarkable volume of summer flow for the small area drained, as indicated by a factor of .61 c.f.s per square mile, estimated in August 1951.

It is of interest that in the 37 years of records of daily flows of the Saugeen at Walkerton, the four highest daily flows recorded, all over 20,000 c.f.s., have all occurred in the last ten years (1941 - 1951).

The gradients of all the branches are illustrated graphically in the Water section of this report. The upper 25 miles of the Main Saugeen, running chiefly through the Dundalk Plain, have a gradient of 9 feet per mile. This part of the river contains many slow-flowing weedy sections. The remaining 36 miles down to Hanover have a gradient of 18 feet per mile. The Rocky Saugeen has a gradient of 15 feet per mile for its upper 34 miles and for the remaining 4 miles, 10 feet per mile. The Styx River falls 36 feet per mile in the first

$2\frac{1}{2}$ miles, the remaining 18 miles averaging 15 feet per mile. Camp Creek has the steepest overall gradient of the major branches, averaging 35 feet per mile through its 14 miles. The remaining tributaries with few exceptions flow slowly from headwater swamps, falling more rapidly in their lower sections. Only Traverston Creek and Black's Creek enter the river with extensive falls over bedrock.

4. Temperature Conditions

Of over a hundred species or groups of aquatic bottom fauna identified, some were distributed at nearly all the places visited. Others, on account of their scarcity, occurred irregularly in collections. The remainder are the ones which were abundant in particular parts of the stream and are indicators of special conditions existing in these parts of the stream throughout the year. Some of the organisms used are listed in the table below.

Some indicator organisms used to determine characteristics of the streams. These are insect larvae or nymphs of mayflies, stoneflies, caddisflies and dobson flies.

Organism	Indicates
1. Neoperla clymene	Very warm in summer
2. Corydalis cornutus	"
3. Stenonema bipunctatum	"
4. Ephemerella deficiens	Intermediate temperatures in summer
5. Baetis levitans	Cool
6. Baetis macdunnoughi	"
7. Nemoura spps.	Cold in summer, spring-fed
8. Baetis vagans	"
9. Baetis brunneicolor	"
10. Hydropsyche in rapids	Permanent flow in summer

The chief temperature characteristics affecting the distribution of fish of the Saugeen are shown on the accompanying map.

With the exception of one or two tributaries, the Saugeen River from its source down nearly to Hanover is satisfactory trout water as far as temperature is concerned. This is a distance of over forty miles along the longest

The Rocky Saugeen near Markdale has excellent cover from logs and debris and is well shaded. Here also the river bottom is remarkably even in depth.

This log jam on the Rocky Saugeen in Glenelg Township tends to block the movement of fish up and down the stream, but it also provides excellent fish cover.

The gorge of the Rocky Saugeen below Hayward Falls in Glenelg Township provides spectacular scenery and easy fly fishing but lacks good holes and fish cover.

tributary, a phenomenally extensive trout section. The chief physiographic feature contributing to this condition is the great number of springs, both at the sources and along the courses of most of the tributaries, which supply initially cool water. Many of these springs come from the reservoir in the limestones which slope south-westward from the edge of the escarpment. Others are associated with the Singhampton moraine flanking the northern edge of the watershed and with the gravelly kame moraines prominent in many parts of the watershed. Other contributing conditions include the rapid flow of many of the streams in all but their uppermost sections, and the fact that the well-treed banks shade the water of most of the tributaries. This follows, of course, from the fact that the spillways through which the streams run are to a large extent non-agricultural.

The accompanying table gives some comparative temperature data for locations shown with the letters A - H on the map "Biological Conditions of Streams" for the week of July 25-31, the warmest week of the summer of 1951. It is shown in the section "Permanence of Flow" above that the flow in 1951 was close to the average, neither very low nor very high.

TABLE I

AIR TEMPERATURES AND TEMPERATURES OF THE WATER (FAHRENHEIT) FOR SELECTED STATIONS A-H FOR THE WEEK JULY 25-31, THE WARMEST WEEK OF THE 1951 SEASON

	Air Temperatures (Degrees Fahrenheit)	Water Temperatures (Degrees Fahrenheit)			
		Rocky Saugeen		Main River	
		A	B	C	D
Maximum	86	72	73	75	77
Average Maximum	81	71	71.5	73.5	75.5
Mean	70	66	68	68.5	70
Average Minimum	59	61.5	64	64	65
Minimum	52	58	61	60.5	62

TABLE II

WATER TEMPERATURES JULY 25-31, 1951

(FAHRENHEIT)

	Camp Creek	Styx River		Priceville Section
	E	F	G	H
Maximum	71.5	75.5	80.5	83
Average Maximum	70.5	74.5	79	80.5
Mean	64	69	72	72.5
Average Minimum	58	63.5	65.5	65
Minimum	56	59.5	61	61.5

Temperatures unfavourably high for speckled trout in summer occurred in the Main Saugeen below Priceville over a distance of about 15 miles, throughout the lower part of the Styx River, and in the lowest part of the main river as it approaches Hanover. The two first-mentioned sections have a relatively small flow, a low gradient and much open country as compared with other parts of the river.

The lower section of the trout reaches of the Rocky Saugeen has higher mean temperatures than are found in the smaller tributaries suitable for trout. This correlates with the higher rate of growth of the speckled trout in the Rocky Saugeen compared with the growth of those from the smaller tributaries. The data concerning growth rates are given on a later page.

5. <u>Pollution</u>

The common sources of pollution in Ontario are raw and treated sewage, milk wastes from creameries and cheese factories, various industrial wastes and cattle droppings. None of these appeared to be having a serious effect on the fish life in those parts of the Saugeen River examined.

Fallen trees sometimes block a trout stream so that it spreads out, making a wide, shallow weed-grown section, with good cover but little depth. This tributary enters the Rocky Saugeen from the south near Markdale.

Sawdust enters the Rocky Saugeen from at least two sawmills. It renders the river bottom sterile and also covers gravel spawning beds.

Severe bank erosion is rare on the Rocky Saugeen, but common on the Main River. This eroded bank is on the Main Saugeen below Hanover.

The effects of cattle using the streams were noted at 51 of 225 stations visited. Milk wastes are discharged daily into Camp Creek at the south end of Durham, but the fish life appeared unaffected. Trout were seen feeding on the curd from this effluent†. There have been reports that the fish from this branch are not healthy. No evidence was found of such a condition. One small tributary above Priceville had an oil scum and abundant algae, but the condition was local. The cause was not determined.

There is a group of substances such as fibres, sawdust and silt which are not normally considered as pollutants but which may render the river bottom unsuitable for fish or unproductive of bottom fauna. Sawdust rapidly sinks and renders the river bottom relatively sterile. Large quantities of sawdust are washed down the Rocky Saugeen from Traverston, and it could be found as an important component of the river bottom for at least a mile below the sawmill. It could also be seen in the Rocky Saugeen about one mile below Markdale.

6. Fish Distribution

The following 36 species of fish were taken in the rivers and streams of the watershed during the surveys.

List of Fishes of the Saugeen River

(above Hanover)

Lamprey Family	Petromyzonidae
Michigan brook lamprey	*Ichthyomyzon fossor* Reighard and Cummins
Salmon Family	Salmonidae
* Brown trout	*Salmo trutta* Linnaeus
* Rainbow trout	*Salmo gairdnerii* Richardson
* Eastern speckled trout	*Salvelinus fontinalis* (Mitchill)
Sucker Family	Catostomidae
Common white sucker	*Catostomus commersonnii* (Lacepede)

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† Observed by N. S. Baldwin of the Ontario Department of Lands and Forests.

Minnow Family	Cypridindae
* Creek chub	Semotilus atromaculatus (Mitchill)
Pearl dace	Margariscus margarita (Cope)
* Hornyhead chub	Nacomis biguttatus (Kirtland)
Blacknose dace	Rhinichthys atratulus (Hermann)
Longnose dace	Rhinichthys cataractae (Valenciennes)
Finescale dace	Pfrille neogaea (Cope)
Redbelly dace	Chrosomus eos Cope
Redside dace	Clinostomus elongatus (Kirtland)
Golden shiner	Notemigonus crysoleucas (Mitchill)
Rosyface shiner	Notropis rubellus (Agassiz)
* Common shiner	Notropis cornutus (Mitchill)
Blackchin shiner	Notropis heterodon (Cope)
Blacknose shiner	Notropis heterolepis Eigenmann and Eigenmann
Brassy minnow	Hybognathus hankinsoni Hubbs
Fathead minnow	Pimephales promelas Rafinesque
Bluntnose minnow	Hyborhynchus notatus Rafinesque
Mudminnow Family	Umbridae
Western mud minnow	Umbra limi (Kirtland)
Pike Family	Esocidae
* Pike	Esox lucius Linnaeus
Killifish Family	Cyprinodontidae
Killifish	Fundulus diaphanus (LeSueur)
Perch Family	Percidae
* Yellow perch	Perca flavescens (Mitchill)
Blackside darter	Hadropterus maculatus (Girard)
Johnny darter	Boleosoma nigrum (Rafinesque)
Iowa darter	Poecilichthys exilis (Girard)
Rainbow darter	Poecilichthys caeruleus (Storer)
Fan-tail darter	Catonotus flabellaris (Rafinesque)
Least darter	Microperca microperca (Jordan and Gilbert)
Sunfish Family	Centrarchidae
* Long-ear sunfish	Lepomis megalotis (Rafinesque)
* Rock Bass	Ambloplites rupestris (Rafinesque)
Sculpin Family	Cottidae
Miller's Thumb	Cottus cognatus Richardson
Muddler	Cottus bairdii Girard
Stickleback Family	Gasterosteidae
Brook stickleback	Eucalia inconstans (Kirtland)

* Species of particular interest to anglers are starred.

(The arrangement follows that of Dymond, J. R.: "A List of the Freshwater Fishes of Canada East of the Rocky Mountains" (Misc. Publication No. 1, Royal Ontario Museum of Zoology, Toronto), 1947.)

TROUT COLLECTIONS
BASED ON
COLLECTIONS MADE DURING THE
1951
SURVEY

Small trout streams with a rapid fall such as this one in Glenelg Township are usually poor producers of trout, but nevertheless beautiful to visit.

Many of the largest speckled trout caught in Ontario have come from ponded weedy waters similar to this stretch of the Rocky Saugeen in Artemesia Township.

The distribution of the major game fish species and some others, based on the 1951 collections, is shown on the accompanying map. Further collecting or angling would, of course, increase the known range of some of the species. Rainbow trout, for example, were found only at Durham, but the species is also taken in most seasons elsewhere between Durham and Hanover and in the lower part of the Rocky Saugeen. The map is not intended to provide an estimate of the relative numbers or of the locations where fish of legal size will be found.

Speckled trout were found at 99 of 225 stations visited and probably exist at several other stations where they were not found. They were very widely distributed through the watershed. The chief sections in which they were absent included most of the lower part of the Styx River and the part of the Main Saugeen from Priceville to the junction with the Rocky Saugeen. The cooler waters of the Rocky Saugeen improve the Main Saugeen in summer for several miles below the junction. No trout were found between Allan Park and Hanover. No other important game fish occurs in large numbers in the watershed. A few brown trout are taken, chiefly in the Rocky Saugeen. Rainbow trout are also taken at least as far up as Hanover.

The following notes describe the distribution of some of the more interesting kinds of fish encountered. The Michigan brook lamprey was found only in the lower Styx and in the Main Saugeen below Durham. Common suckers were distributed throughout the river except in the upper Rocky Saugeen. The Creek chub appeared to be the commonest and most widely distributed species of fish in the river. Several of the sixteen species of minnows appeared to be restricted in range to the east or west ends of the watershed. Thus the Rosyface shiner,

while not uncommon, was apparently restricted to the parts of the river west of Durham, and the Redside dace was common in all of the waters east of Durham but not found west of the town.

Pike were found only in the Styx River and near Hanover in the main river but are probably more widely distributed. Yellow perch were taken in several small lakes. Of the six species of darters collected, five were found only in the Styx River and the lower parts of the Main Saugeen. The sixth, the Iowa darter, was more widely distributed, though uncommon.

Of the bass family Long-ear sunfish were found in Black's Creek, the upper Styx and Habermehl Creek and were abundant in many of the lakes. Rock bass were found only in two small tributaries.

Of the Sculpin family the muddler was very common in the cooler waters, while the "miller's thumb" was taken only at nine stations in water not above 59° F. when the collections were made.

7. Trout Growth Rates

Trout scales collected during the survey were examined by the Research Division of the Department of Lands and Forests, Maple, along with scales from other Southern Ontario streams. The following is abstracted from the report of N. S. Baldwin of the Department of Lands and Forests.

> "The scales collected were examined during the winter of 1951-52 and age determination made. The results of these age determinations are summarized in the accompanying tables.
>
> "It would appear that the growth rates of the speckled trout in these southern Ontario waters are quite similar despite the fact that the waters occur in different geological formations and that ponds and streams are also being compared. The small variations that do occur could easily be caused by differences in time of sampling and methods of capture. In the Saugeen collection, for example, sub-legal as well as legal fish were taken. In the Credit River on the other hand only the fish in the anglers' creel were examined and these in most instances were above the seven inch minimum legal length. A heavy bias in the sampling of two-year-olds from the Credit could be present. The small sample of

fish from Cedar Creek has a growth rate below the average.

"There is considerable interest in possible variations in the growth rate of trout in the Saugeen. A breakdown of the data has been made into Rocky Saugeen and five tributary areas. Growth rate of the fish in the main stream is faster than in the tributaries. There is no evidence of real differences in the growth of trout from the five tributary areas.

"The limited data presented will serve for the time being as a basis for comparing growth rates of speckled trout from southern Ontario waters. This information should be extended considerably if it is to be really useful."

TABLE III
AVERAGE LENGTHS OF SPECKLED TROUT OF VARIOUS AGES FROM SOUTHERN ONTARIO WATERS

Stream	Average Length in Inches for Ages				
	Years				
	0	1	2	3	4
Saugeen River	3.3(21)	5.3(91)	7.0(98)	8.9(8)	
Credit River			7.4(25)	8.1(15)	9.0(1)
Wilmot Creek		6.2(18)	7.8(32)	8.7(11)	
Washington Creek (Oxford County)		4.0(1)	6.8(8)		
Cedar Creek (Waterloo County)		4.6(1)	5.1(6)		
Pearen's Ponds			7.8(20)	8.6(29)	12.6(1)

TABLE IV

AVERAGE LENGTHS OF SPECKLED TROUT OF VARIOUS AGES FROM DIFFERENT PARTS OF THE SAUGEEN RIVER
(See accompanying map)

Stream	Average Lengths in Inches for Ages				
	Years				
	0	1	2	3	4
Rocky Saugeen (Main Stream)		5.6(13)	7.3(36)	9.0(6)	
Habermehl Creek	3.2(3)	5.5(11)	7.4(4)		
Camp Creek (North Section)	3.3(3)	5.3(17)	6.8(14)	8.5(2)	
Camp Creek (South Section)	3.1(2)	5.3(6)	5.8(3)		
Markdale Tributaries	3.3(2)	5.0(12)	6.9(6)		
Rocky Saugeen (Headwaters)		5.1(17)	6.7(18)		

Number of fish in each sample given in brackets

8. Trout Populations and Stream Improvements

The Saugeen River has long been famous as speckled trout water. Trout are shown by the present survey to be still remarkably well distributed in the area of the watershed examined. When some allowance is made for the difference of catching them when present in small numbers, it seems that almost every section that might be expected to be suitable trout water from the indicator species of bottom fauna and from the temperature records did actually have trout in it at the time of the survey.

But while the trout were remarkably well distributed the fishing success is reported to have declined greatly since twenty or thirty years ago. The sizes of the larger trout taken in most areas and, in many cases, the number of fish of legal size are both reported to be reduced. There is no statistical evidence for this because the fishing effort and the total fishing time have not been measured nor are the fish weighed or measured in those records which are available of fish taken. One might add that there are probably many more people fishing than formerly. If the same legal catch is distributed amongst more people the impression is gained that there are fewer fish in the river. However, those in the best position to compare the present conditions with the former ones were agreed concerning the reduction. There were many reports that the waters now contain large numbers of very small trout but few of legal size.

Little or nothing is known concerning the present trend in the trout population, i.e. whether the numbers of large trout are now stabilized at a low level or whether a further decline or an improvement is taking place. The evidence needed to show the present trend would have to include measurements of the growth rate and survival of the various "year classes" of both the naturally spawned and the introduced fish. It would also have to include the effects of changes in the river bed, and in the water, and the effects of competing fish.

All of these and the intensity of fishing would have to be measured over a period of years either in the Saugeen or in some similar river of Southern Ontario to provide really useful material. No such study has been made, except the growth rates described earlier in this report.

The present survey was a reconnaissance survey only. The watershed examined contains more than 200 miles of trout waters, large and small. The survey reports show that the trout waters include almost every possible variation of volume of flow, gradient, depth, bottom and bottom fauna (or fish foods), vegetation, shade, cover and competing fish. The maximum summer temperature of the trout waters also varies from 43° Fahrenheit (in a small stream near Durham) to more than 75° in several sections. The present survey cannot therefore be expected to provide detailed plans for improvements of all the many types of stream.

Many and perhaps most of those who fish the Saugeen and its neighbour streams believe that all that is needed to restore the streams to their former productivity is that more and more trout fingerlings or fry should be introduced into them. The known facts do not substantiate this theory, since even those areas which have been consistently and heavily stocked have failed to produce yields equal to those of former years.

In the absence of any well-ordered data concerning fish populations any recommendations for improvements are subject to error. The effects of the competition furnished by great numbers of creek chub and other small fish, and of predation by brown trout and the older speckled trout, are little understood. There are, however, certain obvious deficiencies in the habitat for trout in the watershed. Most of the larger stretches of river, i.e. the Rocky Saugeen below Markdale and the lower part of the Main Saugeen suitable for trout, fall far short of the ideal in the amount of cover for

A privately-owned dam and fish ladder, both constructed to improve the stream for speckled trout, on the Rocky Saugeen in Bentinck Township.

Storage of water for factory operations often results in lowered levels below the dams. The upper photograph shows the Rocky Saugeen at 4.15 p.m.; the lower one shows it at 5.00 p.m. on the same day. The reduction of the river lessens the area which can provide bottom fauna (or fish foods), besides reducing the cover for fish.

trout they afford. Considering their relatively large volume of flow they seem short of good potholes, large boulders with eddies, and submerged logs. Much of the Rocky Saugeen is remarkably even in depth, apart from a short but spectacular stretch below Traverston and the ponds above the seven dams in its course. (The ends of the two log jams of course provide excellent cover.) Owners and lessees of stretches of the river should therefore be encouraged to install low dams and deflectors, which will force the stream to dig holes but will not raise the temperature of the water as impoundments do.

There are many small tributaries to which the same remarks apply, for example several of the tributaries of Camp Creek east of Durham and the creek in Artemesia Township which in its lower course supplies Markdale's water. The latter is a good example of the type of stream which has developed several shallow, wide and weedy sections which could easily be narrowed and improved.

Several of the streams in the watershed, notably some parts of the Styx River and the upper Main Saugeen, are lacking in shade. Owners should therefore be encouraged to make stream bank plantings. (Alders or species of willows which do not tend to spread should be chosen for this purpose.) The cooling effect of the trees would thus extend the trout-producing sections of the river.

While the exact effect of the sawdust which enters the river from at least two sawmills is not known, there is little doubt that it is harmful both to the growth and reproduction of fish, since it produces a sterile bottom and covers gravel beds. The Conservation Authority has the necessary powers to see that this abuse of the river is ended.

The normal flow of the Rocky Saugeen north of Durham is much reduced each weekday afternoon to store water for operations of a factory. As the accompanying photographs show, this bares much of the river bed and of course prevents the


POSTED WATERS
LEGEND
COLLECTION STATIONS
POSTED WATERS - 1951
SCALE MILES
0
1
2
3
MARKDALE
NO 10 HWY
Bells Lake
Townsend Lake
Farden L
Irish L
Louise Lake
STYX
RIVER
McCormick Lake
NO 6 HWY
SAUGEEN
RIVER
PRICEVILLE
NO 4 HWY
DURHAM
Wilder Lake
Marl Lakes
HANOVER
Gillies L
Turner L
PROTON STATION

development of the bottom fauna which would otherwise be found there, besides reducing the cover for trout in the pools that remain. This effect continues far down the river. The gates of the dam should be adjusted so that the flow is reduced as little as possible, so that the pond is just filled at the start of operations next day.

9. Ownership

It may be seen from the map showing the posted waters in the area examined during the 1951 survey that most of the Rocky Saugeen below Markdale, and the choicer fishing areas on other trout-producing tributaries, are now closed to the public. It can hardly be denied that good trout water, open to the public and within reasonable access from the larger centres of population of Southern Ontario, is rapidly becoming a rarity. In other words the sport of trout fishing in a spectacular river is now almost restricted to those who can afford to pay a high price for the privilege. Some governments, for example that of New York State, have already taken note of the situation and have acquired stretches of first-class trout rivers so that they will not be lost to the general public. The Rocky Saugeen River, besides its fishing, has also much spectacular scenery and its gorge contains a very interesting flora including some rare species. The Conservation Authority might therefore give attention to the possibility of acquiring or urging the acquisition of some stretch of the river for the public.

The Conservation Authority might also greatly stimulate stream development by sponsoring the improvement of one or more streams, as a demonstration of what can be done, in lands to be acquired by the Authority for reforestation. Alternatively it might urge that such a demonstration be carried out on one of the small streams in the Grey County Forest. These are already trout water, but could be improved, and one of them is very suitable for the purpose.

Boulders placed across the Rocky Saugeen in Glenelg Township have improved the river for speckled trout, but there is still a shortage of deep holes.

This small trout stream in the Grey County Forest lacks depth.

The same stream after five minutes' work with boulders. The dammed section is much deeper, and a good hole is being dug below the boulders.

Owners along the river, either individuals or clubs, could do themselves and the Province a service by establishing a creel census on their property, listing the date, number and size of the catch and the fishing effort (number of rods and duration of fishing in hours), and by making the information available to the Provincial Department of Lands and Forests. The information would be of little use unless the records were kept over a period of years.

10. Farm Fish Ponds

There is ample room for improvement of this type of fishing. The chief research on management of farm fish ponds has been carried on in southern and warmer climates, and therefore the findings cannot be applied without qualification to an area having the climate of Southern Ontario, but some definite recommendations may be made. Suitable methods for the construction of six types of farm pond are given in the chapter "Farm Ponds", in the Water section of this report.

From the fisherman's point of view, farm ponds are of two main kinds*. The first is the cool pond with continuous inflowing water and maximum temperatures at the surface of about 75° Fahrenheit with cooler bottom. Ponds of this type are usually successful near the headwaters and may range in size from about an acre to 8 or 10 acres. Depth should be 10 feet or more in the deepest part. Spring flow of as low as half a cubic foot per second will maintain a pond of one acre. This type of pond is best adapted to the production of speckled trout or brown trout. These species of trout do not normally reproduce in ponds and must be maintained by periodic restocking. Ponds cold enough for trout should not be stocked with mixed types of fish.

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* An excellent handbook on the details of construction and management of farm fish ponds is "Fish Ponds for the Farm" by F. C. Edminster, published by Charles Scribner's Sons, New York, 1947. Some of the above information is abstracted from this bulletin.

The second and commoner type of farm pond is the warm water pond. Most farms have at least one low spot suitable for a fish pond. It is frequently good practice to have separate ponds devoted to wildlife and fish and to control the aquatic plants in the fish pond.

In managing warm water ponds for fish the following points should be kept in mind.

(1) A minimum depth of 10 feet over at least 25 per cent of the pond should be planned to avoid excessive winter kill, probably the critical factor in fish survival in farm ponds in Ontario.

(2) If suckers, carp or large numbers of minnows are already present in the pond, it is usually best to destroy all fish in the pond before stocking.

(3) It is often necessary to control existing aquatic vegetation. There are both mechanical and chemical methods available.*

(4) There have been few tests made in Ontario of the efficiency of applications of fertilizer in increasing the crop of plankton, the smaller aquatic invertebrates. The research now being carried out in this field may lead to application of fertilizers such as 8-8-4 becoming more general.

(5) Since many of the species commonly recommended for introduction grow very slowly in Ontario waters, research to determine the most satisfactory species in this province will be needed. New ponds and those in which the previous fish have been destroyed might be stocked experimentally with a combination of large-mouth bass (Huro salmoides) and bluegills (Lepomis machrochirus) at the rate of 100 bass and 1,000 bluegills per acre. Fishing should be deferred until some of each species have spawned successfully.

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* Speirs, J. Murray. Summary of Literature on Aquatic Weed Control. Canadian Fish Culturist, 3:(4); August 1948.